Totuskey and Richardson Creeks Total Maximum Daily Load (TMDL) Report for Shellfish Condemnation Areas Listed Due to Bacteria Pollution

Virginia Department of Environmental Quality

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Table of Contents

Table of Contents

List of Figures and Tables

Executive Summary

This document details the development of bacterial a Total Maximum Daily Load (TMDL) for segments of Totuskey and Richardson Creek in Richmond County, Virginia.

The process of developing shellfish water TMDLs may be generalized in the following manner:

1. Water quality monitoring data are used to determine if the bacterial standard for shellfish have been violated;
2. Potential sources of fecal bacteria loading within the contributing watershed are identified;
3. The necessary reductions in fecal bacteria pollutant load to achieve the water quality standard are determined;
4. The TMDL study is presented to the public for comment, after which the final report is approved by the U. S. Environmental Protection Agency (USEPA) and the Virginia Water Control Board;
5. An implementation strategy to reduce fecal bacteria loads is written into a plan and subsequently implemented;
6. Water quality monitoring data are used to determine if the bacterial standard is being met for shellfish waters.

Two distinctly different approaches to determine the sources of fecal pollution in a waterbody are watershed modeling and bacterial source tracking (BST). Watershed modeling identifies potential sources based on information about conditions in the watershed (e.g. numbers of residents, estimated wildlife populations, estimated of livestock, etc.). BST identifies sources of fecal coliforms, specifically the dominant fecal coliform *Escherichia coli*, based on either genetic or phenotypic characteristics of the coliforms. Virginia's Department of Environmental Quality (VDEQ) uses BST, and specifically a method called antibiotic resistance analysis (ARA). This method assumes that fecal bacteria found in four sources: humans, wildlife, livestock, and pets will all differ in their reactions to antibiotics.

VDEQ expanded the impaired segments in this TMDL because annual Virginia Department of Health – Division of Shellfish Sanitation (VDH-DSS) shellfish condemnation assessments indicated that an additional section became impaired since the original 1998 listing. To reduce unnecessary resources spent on repeated TMDL developments for additional segments in the same watershed, VDEQ combined the most downstream mainstem condemnation with the largest number of tributary cove condemnations from previous VDH-DSS condemnations in the watersheds, using the combined surface area and volume of these areas in the TMDL development calculations. This is the concept of maximum extent for shellfish use TMDLs.

A downstream movement of the impaired segments for Totuskey and Richardson Creeks were included based upon VDH-DSS condemnation notice dated March 16, 2007. The impaired segment is Section A of that condemnation notice. A copy of this notice is included in Appendix A.

The maximum extent condemnation in Totuskey Creek, Richardson Creek, and a small portion of the Rappahannock River (VAP-E24E-01-SF) is identified as the main stem portion to the confluence of the Rappahannock River. The applicable state standard specifies that the number of fecal coliform bacteria shall not exceed a maximum allowable level of geometric mean of 14 most probable number (3-tube MPN) per 100 milliliters (ml) and a 90^{th} percentile geometric mean value of 49 MPN/100ml (Virginia Water Quality Standard 9-VAC 25-260-5). In development of this TMDL, the 90^{th} percentile 49 MPN/100 ml was used because it represented the more stringent standard.

Potential sources of fecal coliform consist primarily of non-point source contributions, and include two permitted point source discharges in the watershed. Non-point sources include wildlife; livestock; land application of bio-solids; recreational vessel discharges; failed, malfunctioning, or non-operational

septic systems; and uncontrolled discharges (straight pipes conveying gray water from kitchen and laundry areas of private homes, etc.).

Virginia DEQ and the Virginia Department of Health collaborated to use a simplified volumetric approach to develop the TMDL. The goal of the procedure is to use bacteriological source tracking (BST) data and bathymetric data to determine the sources of fecal coliform violations, the estuarine volumes and the load reductions needed to attain the applicable criteria.

To assist in partitioning the loads from the diverse sources within the watershed, BST samples of fecal coliform bacteria were collected monthly for one year. These samples were compared to a reference library of fecal samples from known sources. The resulting data were used to assign portions of the load within the watershed to wildlife, humans, pets or livestock. The results of this analysis indicated that in Totuskey and Richardson Creeks the primary source of fecal coliforms was livestock, followed by wildlife, human and pets. The presence of large signatures attributable to different components is sufficient to establish potential directions for remediation under a future implementation plan.

Load Allocation Scenarios

The next step in the TMDL process was to determine the appropriate water quality standard to be applied. This was set as the 90th percentile standard because the data established that the 90th percentile had the higher violation rates, and required the greater reduction compared to the geometric mean. Calculated results for each segment were used to establish the existing load in the system. The load necessary to meet water quality standards was calculated in a similar fashion using the water quality standard criterion in place of the ambient water quality value. The difference between these two numbers represents the necessary level of reduction in each segment. The results of the load calculations and the reductions necessary for the watershed and segment are shown below.

Table ES 1.0 90th Percentile Analysis of Current Load & Allowable Load for Totuskey & Richardson Creeks Shellfish Impairment Growing Area 025-071 Section A

Condemnation Area	Volume (m^3)	90th Percentile Fecal Coliform (MPN/100ml)	90th Percentile W.Q. Standard Fecal Coliform (MPN/100ml)	MOS	Current Load (MPN/day)	TMDL Allowable Load (MPN/day)
Totuskey & Richardson Creeks Section A	8048533	887.65	49	Implicit	7.14E+13	3.94E+12

Table ES 1.1 Waste Load Allocation (WLA) for Shellfish Impairment Totuskey and Richardson Creeks Growing Area 025-071 Section A

Facility Name	Design Flow (MGD)	Design Flow (mL/D)	Fecal Coliform Permit Limit Geometric Mean (MPN/100ml)	Facility Daily Load (MPN/Day)	Future Growth Factor of 1% (MPN/Day)	Total *Annual* Load (MPN/Year)	Total *Daily* WLA (Future growth +Daily load) (MPN/Day)
Town of Warsaw WWTP (VA0026891)	0.3	1.41E+09	14	1.59E+08	1.59E+06	5.87E+10	1.61E+08
Haynesville Correctional Facility (VA0023469)	0.15	5.68E+08	14	7.95E+07	7.95E+05	2.93E+10	8.03E+07
						Total WLA	**2.41E+08**

Table ES 1.2 TMDL Summary of the Totuskey Creek and Richardson Creek Shellfish Impairment Growing Area 025-071 Section A (Fecal Coliform)

Condemnation Area	Total Load Allocation (LA)	Total Waste Load Allocation (WLA)	Current Load (MPN/day)	TMDL Allowable Load (MPN/day)	Margin of Safety (MOS)	Required Reduction
Totuskey & Richardson Creeks	3.94E+12	2.41E+08	7.14E+13	3.94E+12	Implicit	95%

Totuskey Creek at the Route 3 Bridge (station 3-TOT005.11) was listed as impaired for the primary use (recreational) in VADEQ's 2006 and 2008 water quality assessment. This report document also includes a primary contact TMDL, shown below. It should be noted the shellfish water quality standard is more stringent than the primary contact standard. Attainment of the shellfish standards will automatically ensure that primary contact standards are being met. Therefore the recreational impairment may be nested in this shellfish TMDL.

Table ES 1.3 Analysis of Current Load & Allowable Load for the Recreation Use Impairment in Totuskey Creek (Enterococci)

Impaired Water body Segment	Volume (m^3)	Enterococci Permit Limit (Geometric Mean) (cfu/100mL)	Current Load (cfu/Day)	TMDL (cfu/Day)
Totuskey Creek (E24E-02-BAC)	5099585	35	1.02E+14	5.30E+12

Table ES 1.4 Waste Load Allocation (WLA) for Recreation Use Impairment in Totuskey Creek (Enterococci)

Facility name	Design Flow (MGD) Outfall	Design Flow (mL/D)	Enterococci Permit Limit Geometric Mean (cfu/100ml)	Facility Daily Load (cfu/100ml)	Future Growth Factor of 1% (cfu/100ml)	Total Daily Load + Future Growth Factor of 1% (cfu/Day)	Total *Annual* Load (cfu/Year)	Total *Daily* WLA (Future growth + Daily load) (cfu/Day)
Town of Warsaw WWTP (VA0026891)	0.3	1.14E+09	35	3.97E+08	3.97E+06	4.01E+08	1.47E+11	4.01E+08
Haynesville Correctional Center Facility (VA0023469)	0.15	5.68E+08	35	1.99E+08	1.99E+06	2.01E+08	7.33E+10	2.01E+08
							Total Daily WLA	**6.02E+08**

Table ES 1.5 TMDL Summary of the Totuskey Creek Recreation Impairment

Impaired Water body Segment	Total Load Allocation (LA) (cfu/Day)	Total Waste Load Allocation (WLA) (cfu/Day)	Current Load (cfu/day)	TMDL Allowable Load (cfuday)	Margin of Safety (MOS)	Required Reduction
Totuskey Creek	5.30E+12	6.02E+08	1.02E+14	5.30E+12	Implicit	95%

Margin of Safety

A Margin of Safety (MOS) is required as part of a TMDL in recognition of uncertainties in the understanding and simulation of water quality in natural systems. For example, knowledge is incomplete regarding the exact nature and magnitude of pollutant loads from various sources and the

specific impacts of those pollutants on the chemical and biological quality of complex, natural water bodies. The MOS is intended to account for such uncertainties in a manner that is conservative from the standpoint of environmental protection. A MOS is either numeric or implicit in the design of the TMDL. In this TMDL the MOS is implicit in the conservative assumptions used in the load calculations, such as using the worst case bacterial concentrations in current load calculations, resulting in the highest and most protective percent reductions.

Recommendations for TMDL Implementation

The goal of this TMDL was to develop an allocation plan that achieves water quality standards during the implementation phase. Virginia's 1997 Water Quality Monitoring, Information and Restoration Act states in section 62.1-44.19.7 that the "Board shall develop and implement a plan to achieve fully supporting status for impaired waters."

Once a TMDL has been approved by EPA, measures must be taken to reduce pollution levels in the waterbody. These measures, which can include the use of better treatment technologies, the installation of best management practices (BMPs) and designation of a No Discharge Zone (NDZ) are implemented in an iterative process that is described along with specific BMPs in the implementation plan. The TMDL developed for the Totuskey and Richardson Creeks watershed impairments provides allocation scenarios that will be a starting point for developing implementation strategies. Additional monitoring aimed at targeting the necessary reductions is critical to implementation development. Once established, continued monitoring will aid in tracking success toward meeting water quality milestones.

Public participation is critical to the implementation process. Reductions in non-point source loading are the crucial factor in addressing the problem. These sources cannot be addressed without public understanding of and support for the implementation process. Stakeholder input will be critical from the onset of the implementation process in order to develop an implementation plan that will be truly effective.

Public Participation

During development of the TMDL for Totuskey and Richardson Creeks watershed, public involvement was encouraged through a public participation process that included public and stakeholder meetings and public comment periods.

The first technical advisory committee and public meetings were held on May 6, 2009. A basic description of the TMDL process and the agencies involved was presented and a discussion was held regarding the source assessment input, bacterial source tracking, and load calculations. Public understanding of and involvement in the TMDL process was encouraged. Input from these meetings was utilized in the development of the TMDL and improved confidence in the allocation scenarios and TMDL process. The TMDL load allocations were presented during the second public meeting held on September 9, 2009. The public meetings were advertised in the local media, signs advertising the meeting were placed at high access road intersections in the watershed for two weeks before the meetings, and email invitations were sent to local government and stakeholders. There was one public comment received during the first public comment period and 1 public comment was received during the final public comment period.

1.0 Introduction

This document details the development of bacterial Total Maximum Daily Load (TMDL) for segments of Totuskey and Richardson Creeks watershed in Richmond County, Virginia. Totuskey and Richardson Creeks were listed as impaired for shellfish use on Virginia's 1998 303(d) Total Maximum Daily Load Priority List, and are still listed as impaired on the current 2008 water quality assessment report.

Due to annual VDH-DSS shellfish condemnation assessments, impaired shellfish waters often fluctuate in area and volume, as well as presence or absence of condemnations from year to year. An impaired area may be added to the 303(d) impaired waters list during one assessment cycle, and undergo several evolutions in size during the VDH-DSS cycles prior to TMDL development. Under this dynamic condition, and to reduce unnecessary resources spent on repeated TMDL developments in the same watersheds, VDEQ determined the maximum extent of condemned areas of all tidal portions of Totuskey and Richardson Creeks and their tributaries from all past VDH-DSS condemnations for development of this TMDL. VDEQ combined the most downstream mainstem condemnation with the largest number of tributary and cove condemnations in previous VDH-DSS condemnations in this watershed, using the combined surface area and volume of these areas in the TMDL development calculations. This is the concept of maximum extent in shellfish use TMDLs.

A TMDL is just one step in a multi-step process that includes a high level of public participation in order to address water quality issues that can affect public health and the health of aquatic life. Water quality standards are regulations based on federal or state law that set numeric or narrative limits on pollutants. Water quality monitoring is performed to measure these pollutants and determine if the measured levels are within the standards set for the uses designated for the waterbody. The waterbodies which have pollutant levels above the designated standards are considered impaired for the corresponding designated use (e.g. swimming, drinking, shellfish harvest, etc.). The impaired waterways are listed on the §303 (d) list reported to the Environmental Protection Agency. Those waters placed on the list require the development of a TMDL intended to eliminate the impairment and bring the water into compliance with the designated standards.

TMDLs represent the total pollutant loading that a water body can contain without violating water quality standards. The TMDL process establishes the allowable loading of pollutants for a water body based on the relationship between pollution sources and in-stream water quality conditions.

Fecal coliform bacteria are the most common cause for the impairments in Virginia shellfish growing waters. Fecal coliforms are associated with the fecal material derived from humans and warm-blooded animals. The presence of fecal coliform bacteria in aquatic environments is an indication that the water may have been contaminated by pathogens or disease-producing bacteria or viruses. Waterborne pathogenic diseases include typhoid fever, viral and bacterial gastroenteritis, and hepatitis A. Filter-feeding shellfish can concentrate these pathogens which can be transmitted and cause disease when eaten uncooked. Therefore, the presence of elevated numbers of fecal coliform bacteria is an indicator that a potential health risk exists for individuals consuming raw shellfish.

The Virginia Department of Environmental Quality (VDEQ) and the Virginia Department of Health – Division of Shellfish Sanitation (VDH-DSS) use a source identification method called bacterial or microbial source tracking (BST or MST) to assist with assigning load allocations for non-point sources. This method is discussed in section 4.4.

1.1 Overview of the TMDL Development Process

A TMDL study for shellfish waters is the first part of a phased process aimed at restoring water quality. This study is designed to determine how much of the pollutant input needs to be reduced in order to achieve water quality standards. The second step in the process is the development of an implementation plan that identifies which specific control measures are necessary to achieve those reductions, their timing for implementation and at what cost. The implementation plan will also outline potential funding sources. The third step will be the actual implementation process. Implementation will typically occur in stages that allow a review of progress in reducing pollutant input, refine bacteria loading estimates based upon additional data and make any identified changes to pollutant control measures. The TMDL development process also must account for seasonal and annual variations in precipitation, flow, land use, and pollutant contributions.

2.0 Designated Uses and Applicable Water Quality Standard

Water quality standards are provisions of state or federal law which consist of a designated use or set of uses for the waters and water quality criteria based upon such uses. The purpose of water quality standards is to protect the public health or welfare, enhance the quality of water and serve the purposes of the State Water Control Law (§62.1-44.2 et seq. of the Code of Virginia) and the federal Clean Water Act (33 USC §1251 et seq.). According to Virginia Water Quality Standards (9 VAC 25-260-5), the term "*water quality standards means provisions of state or federal law which consist of a designated use or uses for the waters of the Commonwealth and water quality criteria for such waters based upon such uses. Water quality standards are to protect the public health or welfare, enhance the quality of water and serve the purposes of the State Water Control Law (§62.1-44.2 et seq. of the Code of Virginia) and the federal Clean Water Act (33 USC §1251 et seq.).*"

2.1 Designated Uses and Criteria

Generally, all tidal waters with salinity in Virginia are designated as shellfish waters. The identification of the applicable river reaches can be found in the river basin tables at 9VAC25-260-390 et seq. For a shellfish supporting water body to be in compliance with Virginia bacterial standards, VDEQ specifies the following criteria (9 VAC 25-260-160): "*In all open ocean or estuarine waters capable of propagating shellfish or in specific areas where public or leased private shellfish beds are present, and including those waters on which condemnation or restriction classifications are established by the State Department of Health the following criteria for fecal coliform bacteria shall apply; The geometric mean fecal coliform value for a sampling station shall not exceed an MPN (most probable number) of 14 per 100 milliliters. The 90th percentile shall not exceed an MPN of 43 for a 5 tube, 3 dilution test or 49 for a 3 tube, 3 dilution test, or MF test of 31 CFU (colony forming units) per 100 milliliters.*

2.2 Classification of Virginia's Shellfish Growing Areas

The Virginia Department of Health, Division of Shellfish Sanitation is responsible for classifying shellfish waters. The VDH- DSS follows the requirements of the National Shellfish Sanitation Program (NSSP), which is regulated by the U.S. Food and Drug Administration. The NSSP specifies the use of a shoreline survey as its primary tool for classifying shellfish growing waters. Fecal coliform concentrations in water samples collected in the immediate vicinity of the shellfish beds function to verify the findings of the shoreline survey and to define the border between approved and condemned (unapproved) waters.

DSS designs and operates the shoreline survey to locate sources of pollution within the watersheds of shellfish growing areas. This is a property-by-property inspection of the onsite sanitary waste disposal facilities on un-sewered sections of watersheds, of other sources of pollution such as wastewater treatment plants (WTP), marinas, livestock operations, landfills, etc. The information is compiled into a written report with a map showing the location of the sources of real or potential pollution found. Once an onsite problem is identified, local health departments (LHDs), and/or other state and local agencies may play a role in the process of correcting the deficiencies.

The VDH-DSS collects monthly seawater samples at over 2,000 stations in the shellfish growing areas of Virginia. Though they continuously monitor sample data for unusual events, they evaluate shellfish growing areas on an annual basis. The annual review uses data from the most recent 30 samples (typically 30 months), collected randomly with respect to weather. The data are assessed to determine whether the water quality standards are met. If the water quality standards are exceeded, the shellfish area is closed for the harvest of shellfish that go directly to market. Those areas that marginally exceed the water quality standard and are closed for the direct marketing of shellfish are eligible for harvest of shellfish under permit from the Virginia Marine Resources Commission and VDH-DSS. The permit establishes controls that in part require shellfish be allowed to depurate for 15 days in clean growing areas or specially designed licensed on shore facilities. Shellfish in growing areas that are assumed to be highly polluted, such as those in the immediate vicinity of a wastewater treatment facility (prohibited waters), are not allowed to be moved to clean waters for self purification.

3.0 Watershed Characterization

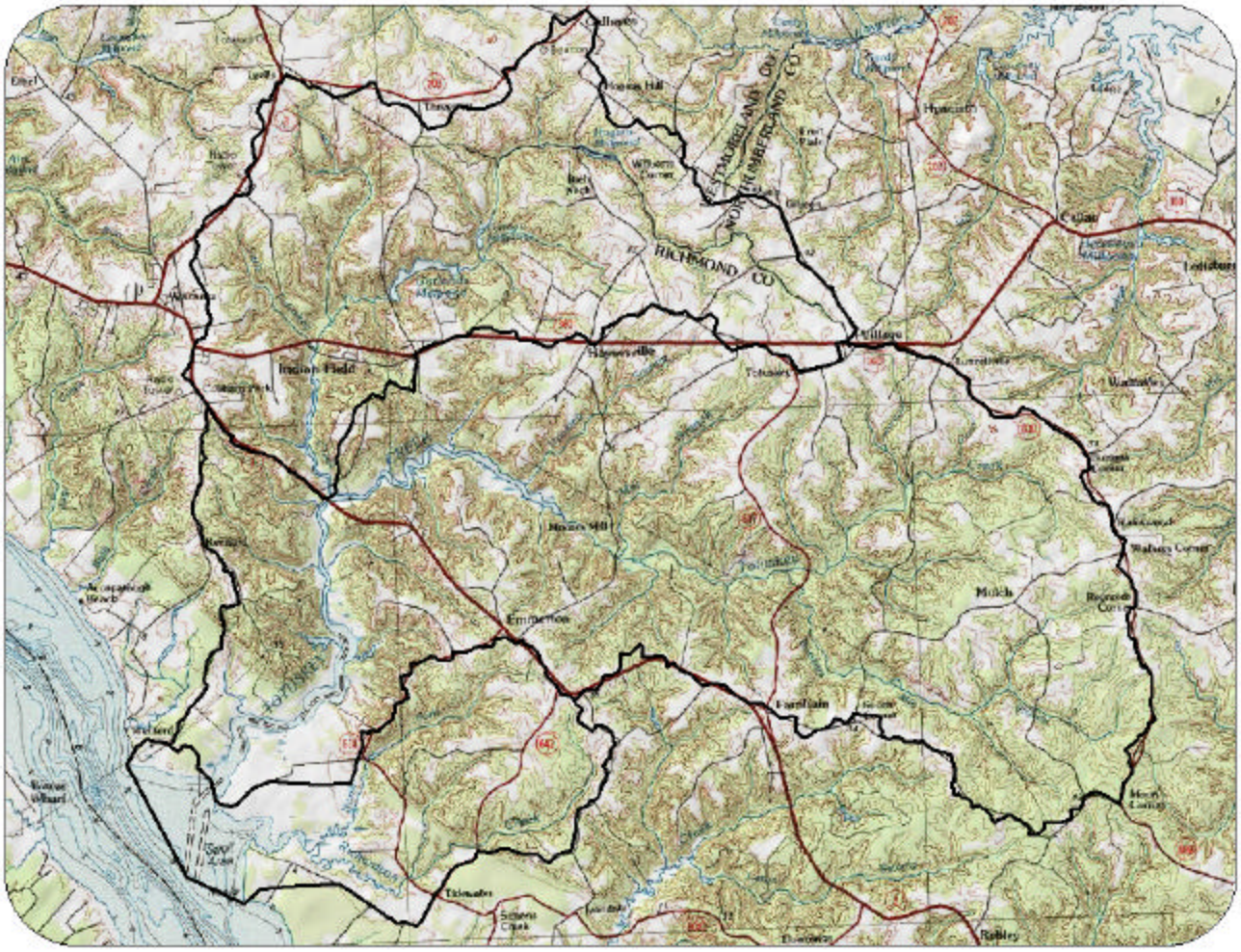
Collective Watershed

The collective watershed occupies a landscape position which bisects Richmond County. See Figure 3.0 for a topographic map of the collective watershed. Totuskey and Richardson Creeks flow into the Rappahannock River and into the Chesapeake Bay. The collective watershed is bound on the west by route 630, the north-west by route 3, to the north by route 203 and to the north-east by route 600. To the east it continues to be bound by route 600, and to the south-east by routes 602, 611 and 613. The communities of Haynesville, Warsaw, Indian Field, Emmerton, Farnham, Mulch, Threeway, and Oldhams are located within the collective watershed. The drainage area of the collective watershed is approximately 49,511 acres. Population estimate according to the 2008 Census for the County of Richmond was 9,144. The population of the Totuskey and Richardson Creeks watershed is approximately 3,780 people, according to the 2000 census. Population is considered moderate and growing with new communities under development. (DSS Shoreline Survey Richmond County 2005).

Some portions of shellfish growing areas are either permanently or seasonally closed to direct shellfish harvesting due to the presence of either marinas or wastewater treatment facility discharges. In these cases, DSS uses a computer model to determine the size and shape of the closure area based on the potential fecal input, *e.g.*, number of boats in a marina or the number of gallons of sewage permitted for the treatment facility. DSS is careful to ensure that a sufficient area is closed to protect public health under even high pollution events without condemning excessive waters.

Section B of Totuskey Creek is permanently closed due to the presence of the Warsaw Wastewater Treatment Plant. These shellfish waters are permanently closed to shellfish harvesting as a public safety measure due to the possible presence of viral pathogens. A list of all permitted point sources in Totuskey and Richardson Creeks may be found in Section 4.3, Table 4.1.

Figure 3.0 Totuskey and RichardsonCreeks and Tributaries Topographic Map



Land Use

Land use in the individual watersheds is shown in Figures 3.1 through 3.4 and Tables 3.0 through 3.1. In Totuskey Creek, approximately 60% of the land use is comprised of forest, 19% is Pasture land, 13% is cropland, 5% is wetland, 1% is open water, 1% barren or mining and 1% is urban. In Richardson Creek, approximately 53% of the land use is comprised of forest, 23% is Pasture land, 12% is cropland, 6% is wetland, 3% is open water, and 2% barren or mining. There were no reported use of "transitional" land, and for Richardson Creek there were no reported Urban areas. Land use information was gathered from the 1992 National Land Cover Database (NLCD).

Figure 3.1 Land Use for Totuskey Creek Watershed

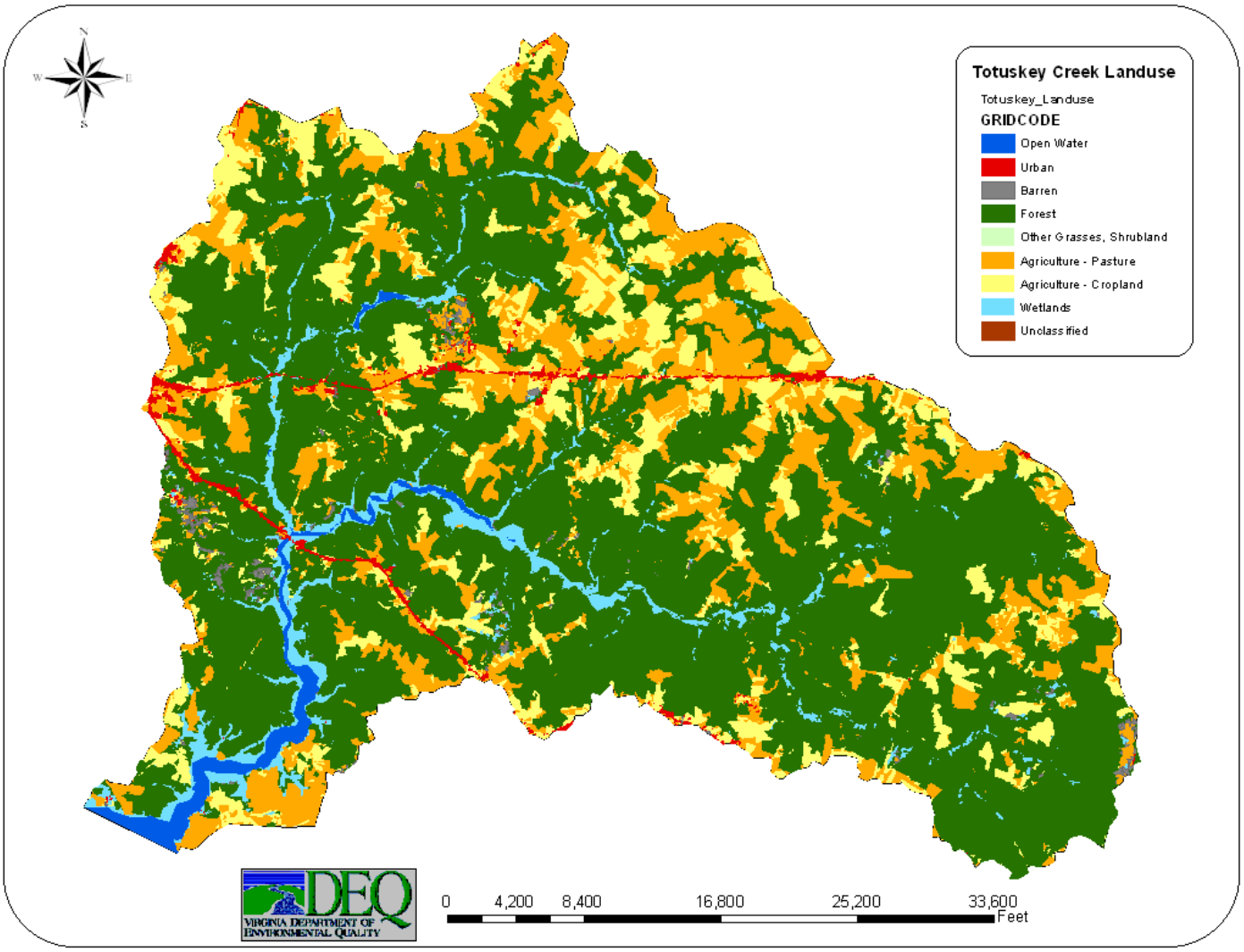


Table 3.0 Totuskey Creek Watershed Percentages by Land Use Types

Land Use Type	Acres	Square Miles	Percent
Open Water	566.63	0.89	1%
Urban	521.35	0.81	1%
Barren or Mining	301.02	0.47	1%
Transitional	0	0	0%
Forest	26313.7	41.12	60%
Agri - Pasture	8371.25	13.08	19%
Agri - Cropland	5802.79	9.07	13%
Wetland	2083.4	3.26	5%
Totals:	**43960.14**	**68.7**	**100%**

Figure 3.2

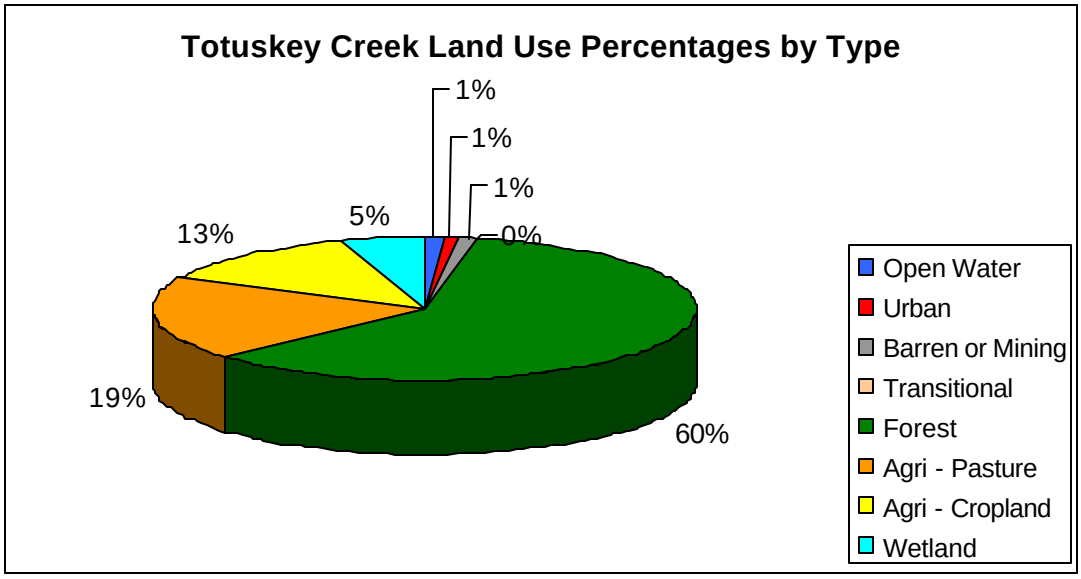


Figure 3.3 Land Use for Richardson Creek Watershed

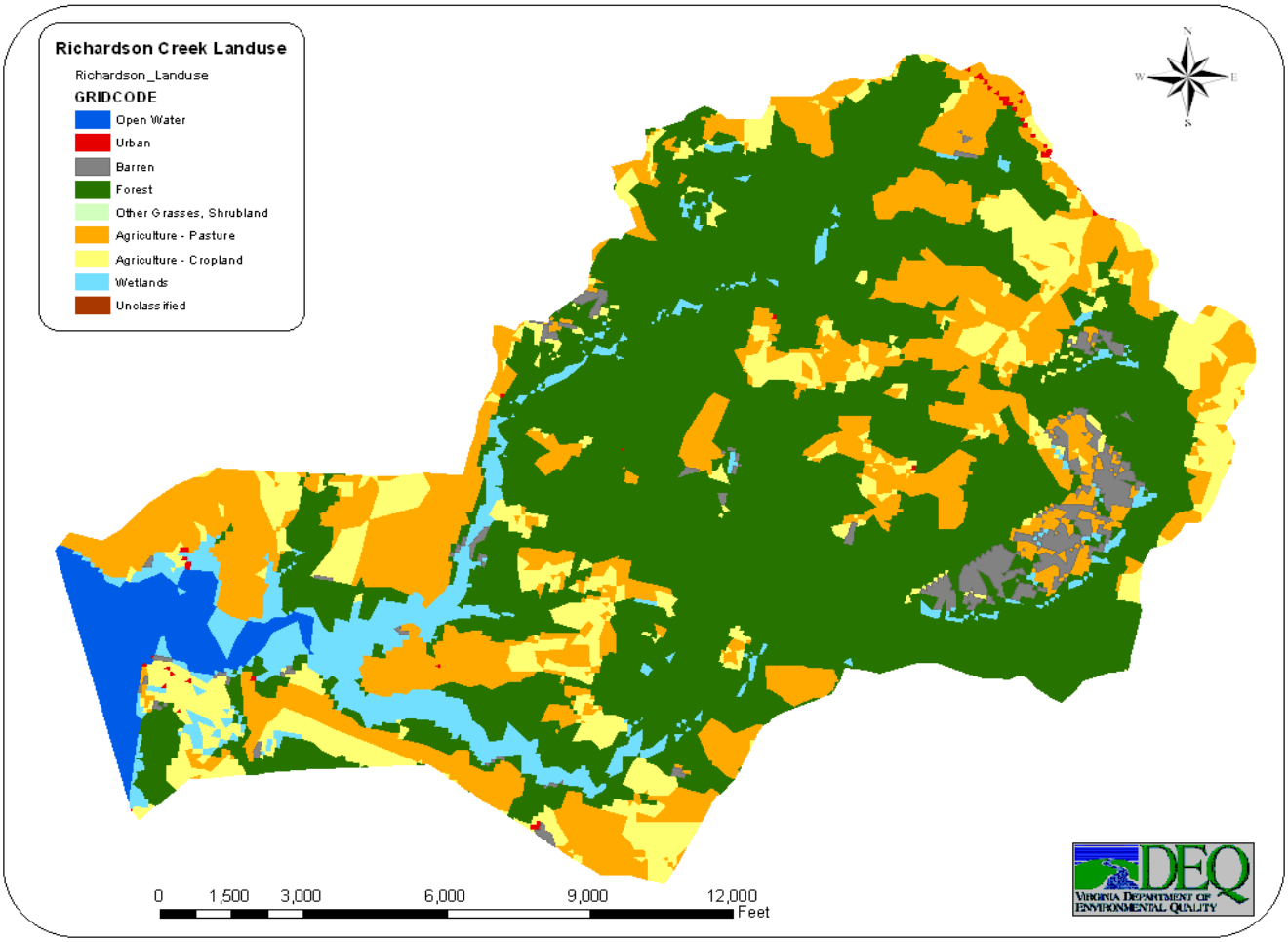
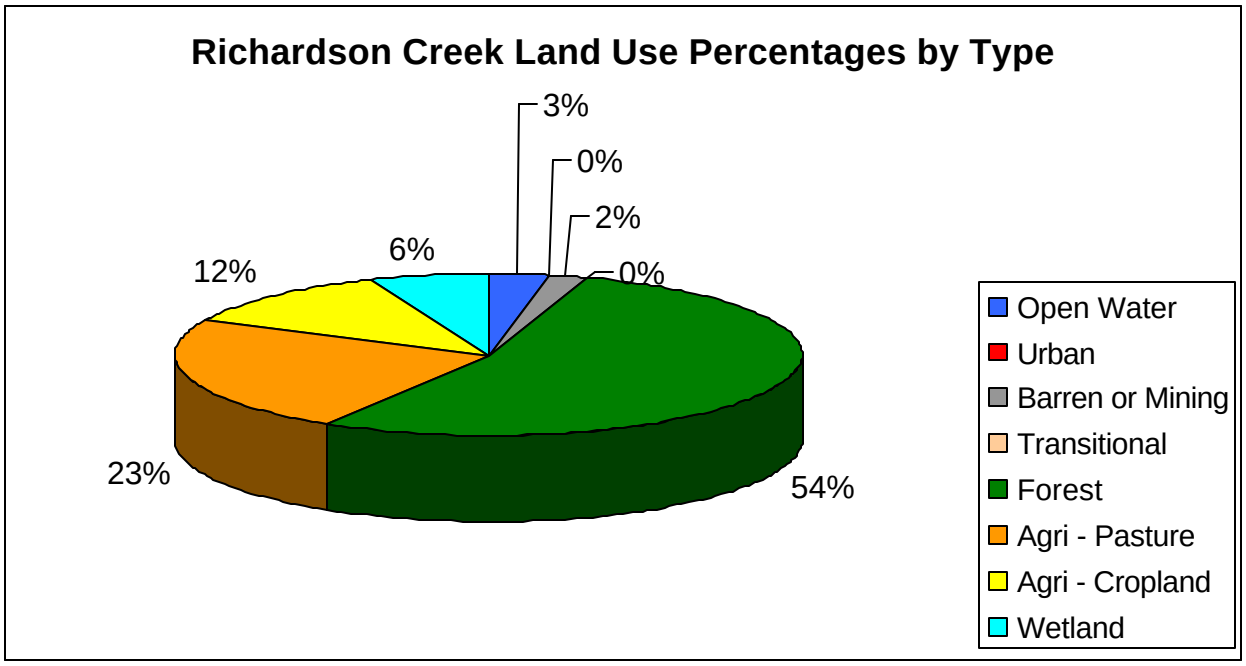


Table 3.1 Richardson Creek Watershed Percentages by Land Use Types

Land Use Type	Acres	Square Miles	Percent
Open Water	190.32	0.3	3%
Urban	8.16	0.01	0%
Barren or Mining	131.67	0.21	2%
Transitional	0	0	0%
Forest	2920.24	4.56	53%
Agri - Pasture	1296.56	2.03	23%
Agri - Cropland	649.42	1.01	12%
Wetland	354.77	0.55	6%
Totals:	**5551.14**	**8.67**	**99%**

Figure 3.4



3.1 Geology and Soils

Totuskey and Richardson Creeks and Tributaries are in the Atlantic Coastal Plain physiographic region. The Atlantic Coastal Plain is the easternmost of Virginia's physiographic provinces. The Atlantic Coastal Plain extends from New Jersey to Florida, and includes all of Virginia east of the Fall Line. The Fall Line is the easternmost extent of rocky-river rapids, the point at which east-flowing rivers cross from the hard, igneous and metamorphic rocks of the Piedmont to the relatively soft, unconsolidated strata of the Coastal Plain. The Coastal Plain is underlain by layers of Cretaceous and younger clay, sand, and gravel that dip gently eastward. These layers were deposited by rivers carrying sediment from the eroding Appalachian Mountains to the west. As the sea level rose and fell, fossiliferous marine deposits were inter-layered with fluvial, estuarine, and beach strata. The youngest deposits of the Coastal Plain are sand, silt and mud presently being deposited in our bays and along our beaches (http://www.geology.state.va.us/DOCS/Geol/coast.html).

Soils for the Totuskey and Richardson Creeks and tributaries watershed were documented utilizing the VA State Soil Geographic Database (STATSGO). Four general soil types were identified in this database. Descriptions of these soil series were derived from queries to the USDA Natural Resources Conservation Service (NRCS) Official Soil Series Description web site (http://ortho.ftw.nrcs.usda.gov/cgi-bin/osd/osdname.cgi). Figure 3.5 shows the location of these general soil types in the watershed.

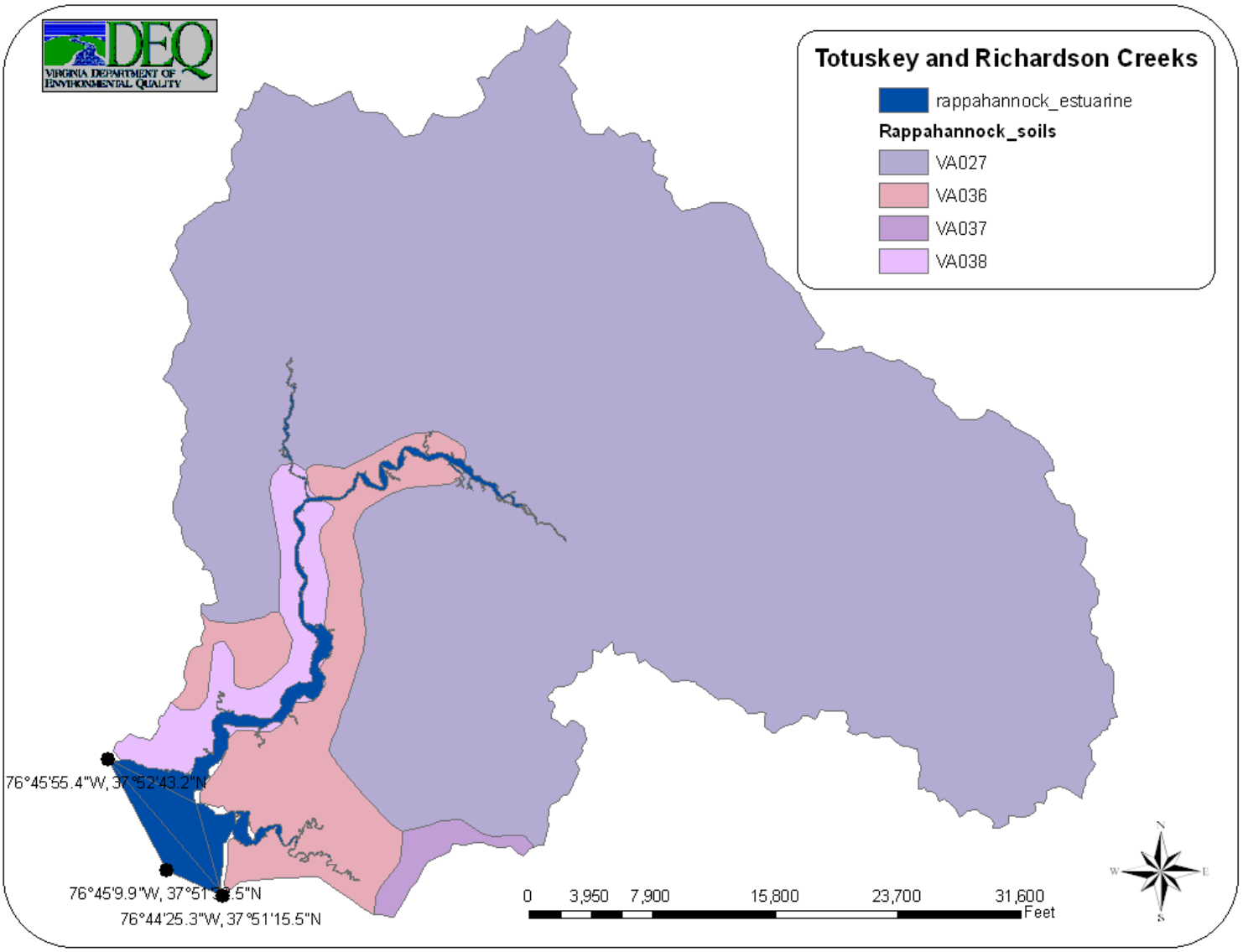
Soils of the Emporia-Johnston-Kenansville-Remlik-Rumford-Slagle-Suffolk-Tomotley (VA027) series are very deep to deep, and vary between well drained to poorly drained with moderately slow or slow permeability. They formed in moderately fine-textured stratified fluvial and marine sediments on the upper Coastal Plain and stream terraces.

Soils of the Tetotum-Nansemond-State-Emporia-Dragston-Nimmo-Bladen Series (VA036) are very deep and range from well drained to poorly drained. Permeability ranges from moderately rapid and/or rapid to moderately slow or slow. This soil series was formed in sandy or loamy fluvial and marine sediments on Coastal Plain uplands and stream terraces.

Soils of the Bibb and Levy-Bohicket-Lumbee-Nansemond-Rumford-Tetotum-State-Suffolk (VA037) are very deep to deep, and vary from well drained to very poorly drained. They range in slope from 0 – 15 percent. Their water capacity varies from low to high. This soils series was formed in sandy to loamy to mucky clay alluvial and marine sediments on the upper Coastal Plain and stream terraces.

Soils of the Pamunkey-Nansemond-Bibb-Kinston-Nawney-Bohicket Series (VA038) are very deep, poorly to well drained soils, and range from well to moderately well to slow permeability. These soils are located on low stream or marine terraces and in the flood plains in the Piedmont and the Coastal Plain Physiograph Provinces. These soil series are formed in fine to coarse loamy marine and fluvial sediments and sandy alluvium.

Figure 3.5 Totuskey and Richardson Creeks & Tributaries Soils Map

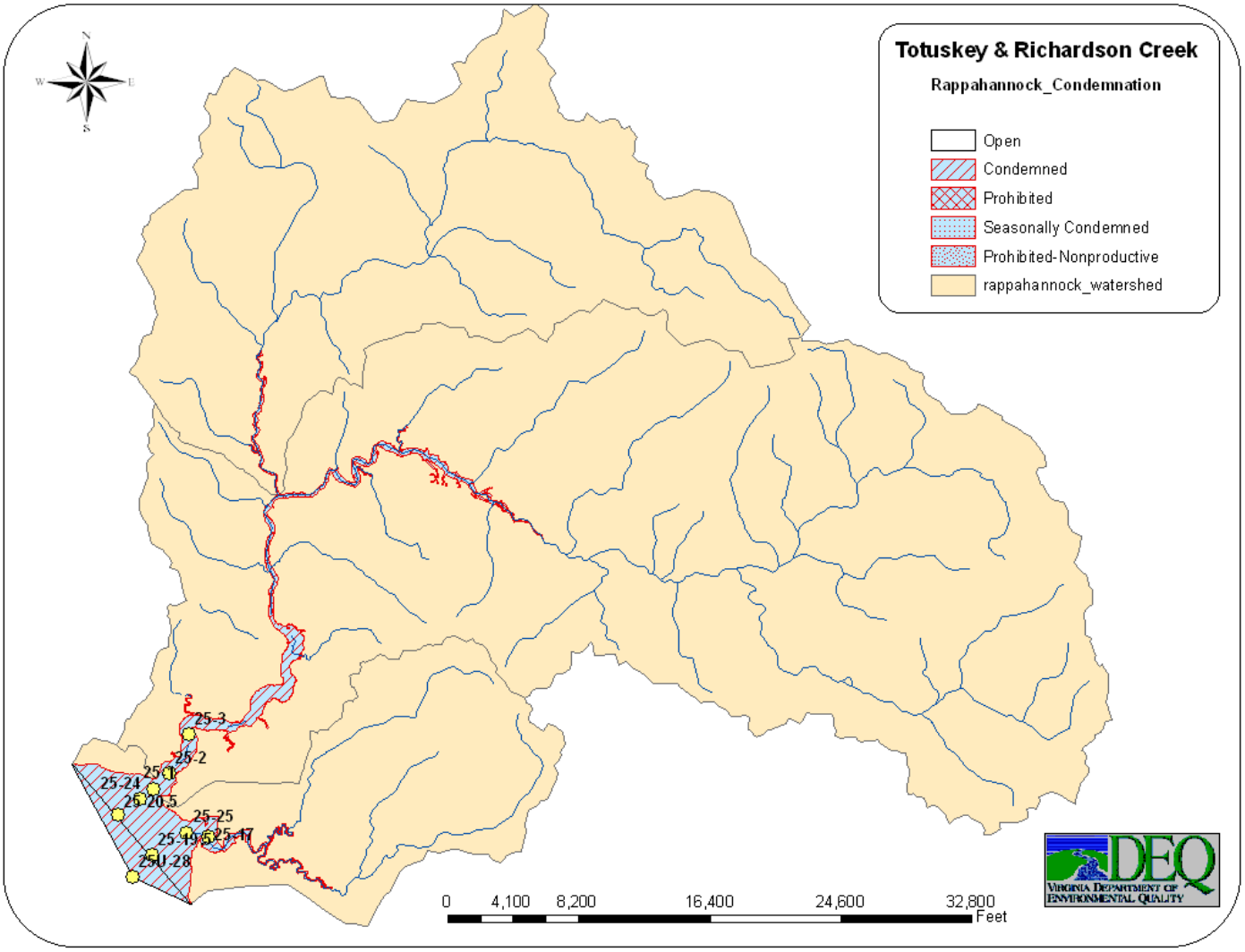


4.0 Water Quality Impairment and Bacterial Source Assessment

4.1 Water Quality Monitoring

The VDH-DSS water quality monitoring network for Totuskey and Richadson Creeks consists of eight monitoring stations throughout the embayment. These stations are monitored by the VDH-DSS for fecal bacteria. The locations of the water quality monitoring stations utilized for this study are shown in Figure 4.0.

Figure 4.0 Totuskey and Richardson Creeks Stations and Condemnations Map



This TMDL study examined bacterial monitoring data at these stations from December 1984 through July 2008. A summary of water quality data from the stations in or bordering condemned areas of maximum extent for the monitoring period preceding the TMDL study (historic data) is shown in Table 4.0.

Table 4.0 Water Quality Data Summary Totuskey and Richardson Creeks
Condemnation # 025-071

Creek Name	Station	Total Observations (1/mo)	Geometric Mean	Station Violates Geometric Standard: 14 MPN	90th Percentile	Station Violates 90th Percentile Standard: 49 MPN
Totuskey & Richardson Creeks Section A	25-1	260	34.6	Yes	293.55	Yes
	25-2	262	48.8	Yes	622.43	Yes
	25-3	262	65.9	Yes	701.19	Yes
	25-17	247	100.29	Yes	887.65	Yes
	25-19_5	31	6.20	No	37.47	No
	25-20_5	31	5.00	No	23.31	No
	25-24	261	27.6	Yes	198.43	Yes
	25-25	260	32.15	Yes	221.34	Yes

Graphs depicting the geometric mean and 90th percentile for the condemned areas of Totuskey and Richardson Creeks are shown in Figures 4.1A – 4.2A. The closures in the growing areas are characterized based on all monitoring stations (see Figure 4.0) in the condemnation areas.

Figure 4.1A

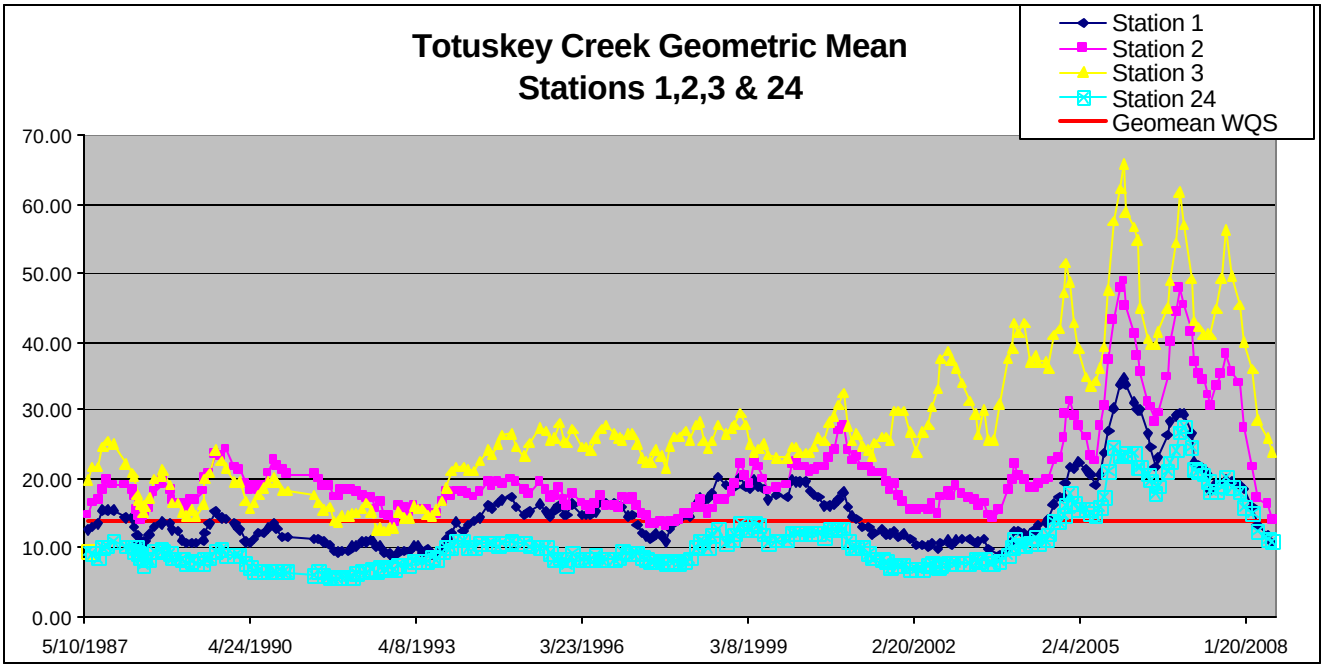


Figure 4.1B

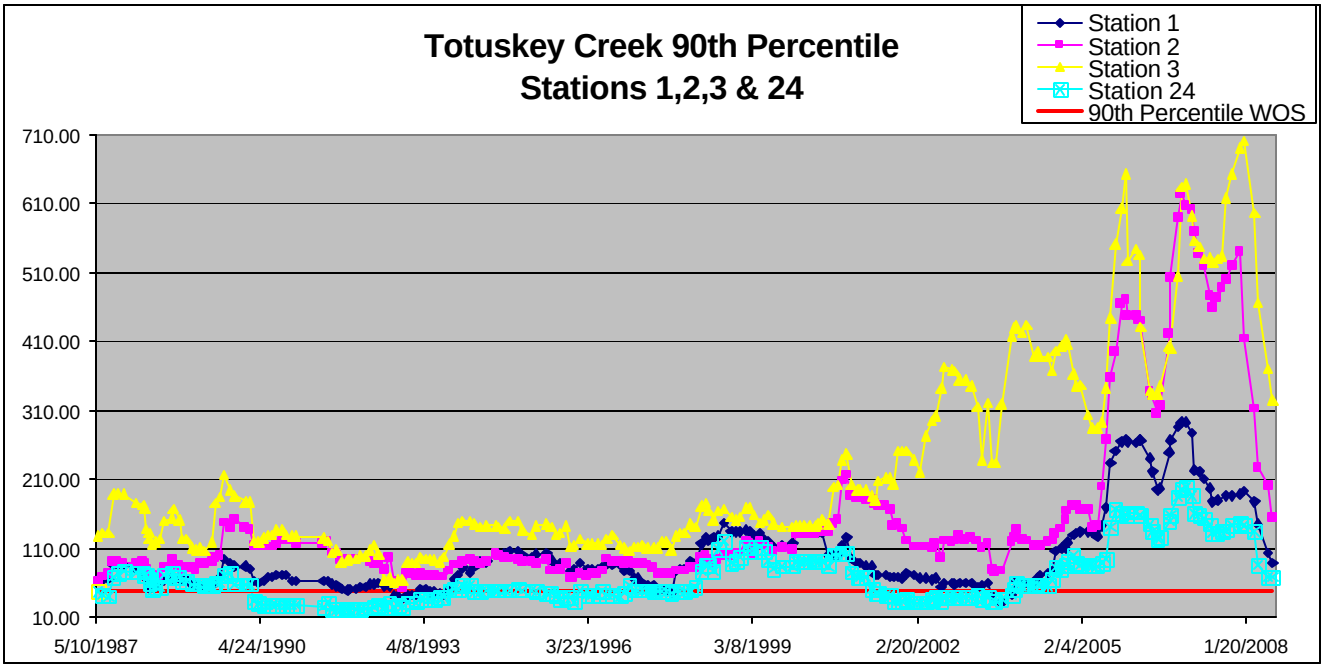


Figure 4.2A

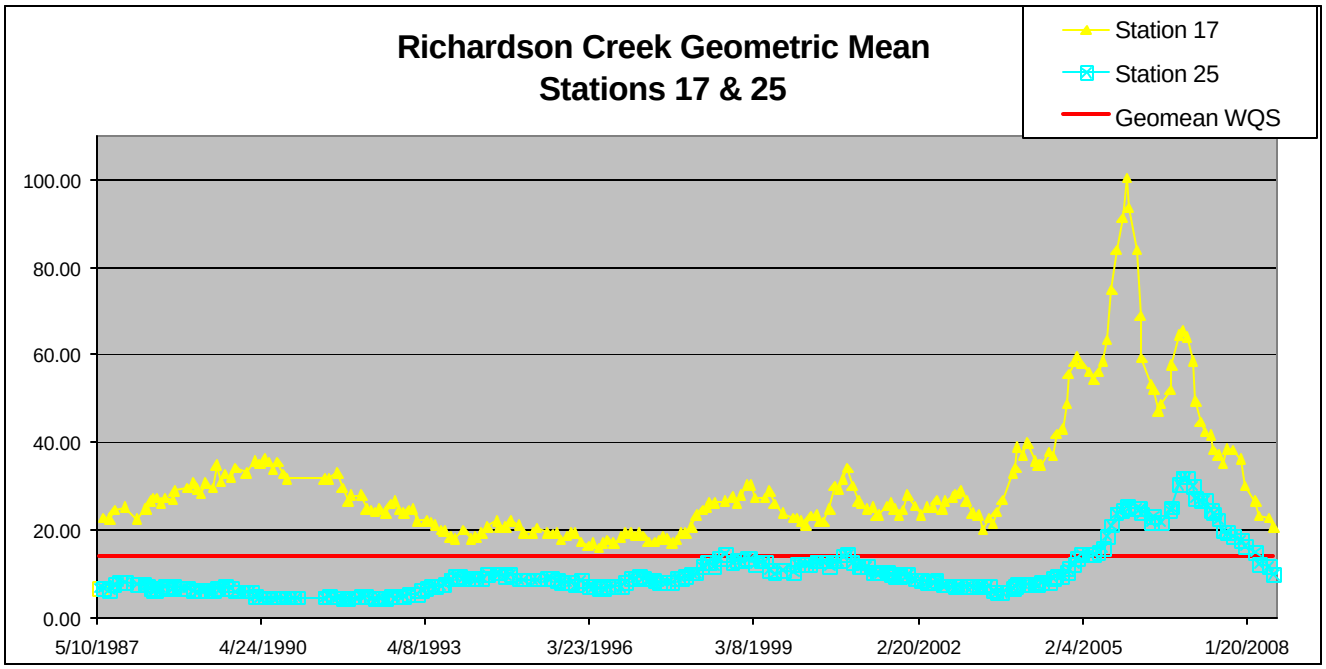
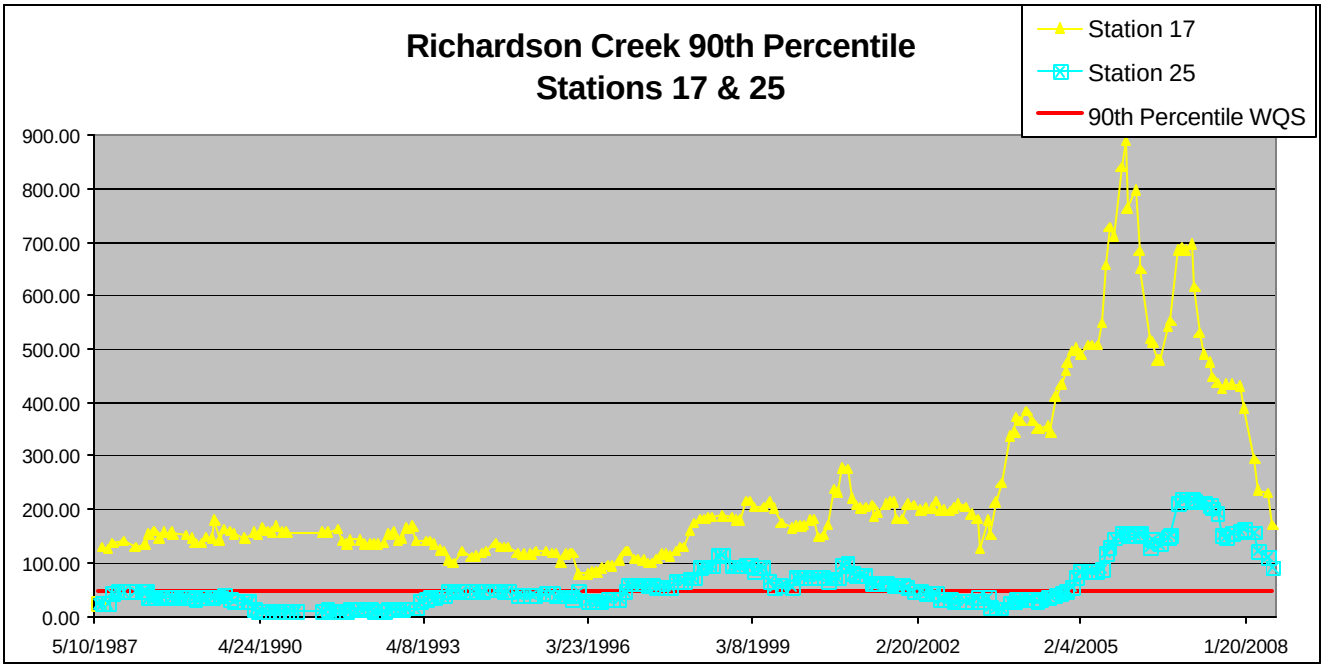


Figure 4.2B



VDEQ also monitors for *Enterococcus*, an organism used for detection of bacteria for the primary contact or recreational use in Virginia's brackish (estuarine) waterways as it is a good indicator of human pathogens. The upper-tidal portion of Totuskey Creek at the route 3 bridge (station 3-TOT005.11) was assessed as not supporting the recreational use in 2006. It was re-listed as not supporting the recreational use in 2008 with a violation rate of 7/18 (39% violations). Due to the conservative nature of shellfish water quality standards, the implementation of the shellfish TMDL in Totuskey Creek is expected to achieve the reductions needed to meet the primary contact water quality standards. Therefore, the recreational impairment will be nested in the shellfish TMDL and a separate primary contact TMDL will not be required for Totuskey Creek. The summary of monitoring data for the primary contact impairment is available in Table 5.3.

4.2 Condemnation Areas

One segment within Totuskey and Richardson Creeks was listed as impaired on Virginia's 1998 303(d) water quality standard for fecal coliform bacteria in shellfish supporting waters. However, the TMDL is using the VDH-DSS condemnation areas dated 3/16/07 for Totuskey and Richardson creeks because these present the condemnation areas of maximum extent to date, as explained in Section 1.0 of this report. The use of maximum extent in regards to shellfish condemnations results in the most protective load allocations.

Detailed maps of the shellfish condemnation areas and their associated water quality stations are available from the Virginia Department of Health, Division of Shellfish Sanitation. A map of the condemnation areas is shown in Figure 4.1. Copies of the original and subsequent condemnation notices of all closures are in Appendix A.

4.3 Fecal Coliform Bacteria Source Assessment

A. Point Sources

The Town of Warsaw Wastewater Treatment Plant (WWTP) (VA0026891) and Haynesville Correctional Center WWTP (VA0023469) are the only facilities permitted for fecal coliform control

and these discharge to Totuskey and Little Totuskey Creeks respectively. There are no facilities permitted for fecal coliform control on Richardson Creek. Therefore, the Warsaw WWTP and Haynesville Correctional Center WWTP are the only dischargers to receive a Waste Load Allocation (WLA) in this report. Table 4.1 illustrates all facilities with DEQ permits within the watershed.

Totuskey Creek & Tributaries

The Town of Warsaw WWTP (VA0026891) operates as a minor municipal facility with two outfalls permitted to discharge to the tidal portion of Totuskey Creek near the Rt. 3 Bridge. Outfall 001 discharges to a tributary to Totuskey Creek, and outfall 002 discharges to Totuskey Creek. Outfall 001 is an old outfall and currently has no discharge, and outfall 002 is their new relocated outfall. Outfalls 001 and 002 are surrounded by a prohibited zone (a type of shellfish closure area) which was issued by VDH-DSS (shown as section B in VDH condemnations). While outfall 001 no longer discharges and contributes no fecal coliform bacteria to the stream, it is included in the waste load allocation (WLA) because it was included in the VPDES permit. The Town of Warsaw WWTP has a design flow of 0.3 million gallon per day (MGD) and is permitted for Fecal Coliform limits of geometric mean 200 MPN/100 milliliters. Outfalls 001 and 002 should not be in operation simultaneously as the Design Flow of 0.3 MGD is the permitted design in the permit for a single outfall. The WLA assigned in this TMDL report for the Warsaw WWTP allows for the operation of one outfall with a maximum design flow of 0.3 MGD. The WLA calculations are available in Table 5.6.

The Haynesville Correctional Center WWTP (VA0023469) operates as a minor municipal facility with two outfalls permitted to discharge the non-tidal portion of an unnamed tributary to Marshy Swamp. Outfall 001 discharges to a tributary to Marshy Swamp, which flows into Little Totuskey Creek, and outfall 101 discharges to an oxidation ditch before it is combined with outfall 001. The Haynesville Correctional Center WWTP has a design flow of 0.15 million gallon per day (MGD) and is permitted for total chlorine residual in outfall 101, a surrogate for fecal coliform bacterial limits of geometric mean 200 MPN/100 milliliters. Outfall 001 is permitted for Fecal Coliform limits of geometric mean 200 MPN/100 milliliters. Outfalls 001 and 101 are allowed to be in operation simultaneously as the Design Flow of 0.15 MGD is the permitted design in the permit for both of the outfalls. The WLA assigned in this TMDL report for the Haynesville Correctional Center WWTP allows for the operation of both of the outfalls with a maximum design flow of 0.15 MGD. The WLA calculations are available in Table 5.6.

The facility Wood Preservers Incorporated (VA0083127) has a stormwater permit with two outfalls, outfall 001 and outfall 002 that discharge to Totuskey Creek. They are not permitted for fecal coliform control and therefore, do not receive a WLA in this report as the facility does not contribute to the bacterial impairment.

The facility Warsaw Used Auto Parts Plus (VAR051239) has an industrial stormwater permit with one outfall (001) that discharges into Totuskey Creek. They are not permitted for fecal coliform control and therefore, do not receive a WLA in this report as the facility does not contribute to the bacterial impairment.

The Warsaw WWTP reported sewer overflows at the plant for the months of April and November of 2004, and one in October of 2005. This time frame is included within the study period and 2 of the overflows occurred during the time frame when BST samples were being taken. The facility's Discharge Monitoring Report (DMR) did not show any exceedences of their permit for fecal coliform during the sampling time frame.

Table 4.1 Permitted Point Sources in Totuskey and Richardson Creeks and Tributaries

Stream Name	Facility Name	VPDES Permit Number	Outfalls	Permit Type	Permitted for Fecal Coliform Control	Design Flow (MGD)
Totuskey Creek	Town of Warsaw WWTP	VA 0026891	001, 002	Municipal Minor	YES	0.3
UT to Garlands Millpond (to Little Totuskey Creek)	Haynesville Correctional Center WWTP	VA 0023469	001, 101	Municipal Minor	YES	0.15
UT to Totuskey Creek	Wood Preservers Incorporated	VA0083127	001, 002	Municipal Minor	NO	1.16
Totuskey Creek	Warsaw Used Auto Parts Plus	VA R051239	001	General Stormwater Industrial	NO	N/A

B. Non-Point Source

Non-point sources of fecal coliform do not have one discharge point but may occur over the entire watershed of the receiving water. Fecal coliform bacteria deposited on the land surface can build up over time. During rain events, surface runoff transports water and sediment to waterways. Sources of fecal coliform bacteria include grazing livestock, concentrated animal feeding operations, manure application, and wildlife and pet excretion. Direct contribution to the waterway occurs when livestock or wildlife defecate into or immediately adjacent to receiving waters. Non-point source contributions from humans generally arise from failing septic systems and associated drain fields, moored or marina vessel discharges, storm water management facilities, pump station failures, and ex-filtration from sewer systems. Contributions from wildlife, both mammalian and avian, are natural conditions and may represent a background level of bacterial loading. It is therefore likely that human loading is due to failures in septic waste treatment systems and/or potential pollution from recreational vessel discharges.

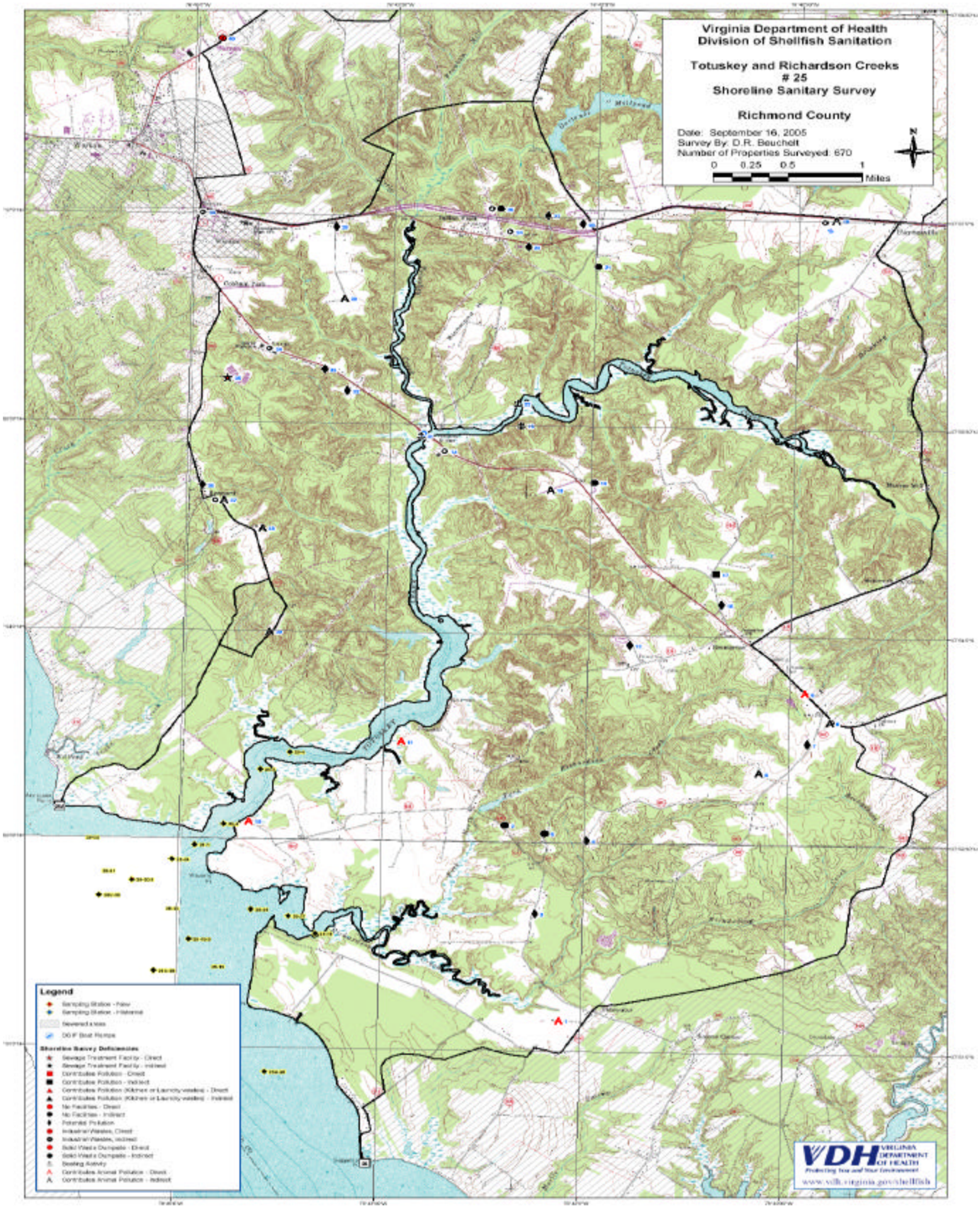
The shoreline survey is used as a tool to identify non-point source contribution problems and locations. Figure 4.3 shows the results of the DSS sanitary shoreline survey for Totuskey and Richardson Creeks dated 2005. The survey identified three onsite sewerage deficiencies, 3 boating sources, and 12 animal sources. Copies of the survey are included in Appendix A.

VDH-DSS conducts new Sanitary Surveys every 8 years for each of the growing areas. Corrected violations are updated on a regular basis however new deficiencies are only reported when a new survey has been completed.

A VDH permitted non-point source facility, Beasley Septage Disposal Facility (#179-01), lies within the drainage of an unnamed tributary to Totuskey Creek. This facility may also land apply effluent within its permit (at specified locations on the same property). DEQ pollution response staff has inspected the facility three times, the first beginning in 2003 with return visits in 2007 and 2009. During DEQ visits at the facility, the septage lagoons were observed with less than the required 2 feet of freeboard space and staff reported physical evidence along the lagoon berms to suggest that overflows of the septic lagoons have occurred at some point in time. Monitoring was conducted during by DEQ in 2003 to gauge bacteria concentrations downstream of the lagoons along the unnamed

tributary. The results, which included violations of the recreational and shellfish use water quality standards, are in Table C3 Appendix C. During a follow-up inspection by VDH personnel in 2009, the septage lagoons were observed with a minimum of 2' freeboard and the inspector noticed no evidence of overflow although there was erosion along the berm of the lagoons. The facility should be involved during implementation planning.

Figure 4.3 Virginia Department of Health – Department of Shellfish Sanitation Shoreline Sanitary Survey Map for Totuskey and Richardson Creeks



Wildlife & Livestock

Livestock numbers in Table 4.3 were gathered through observations made by DEQ TMDL staff by traveling through watersheds and making head counts of livestock/pets which were visible from roads. We compared our numbers with those numbers given to us through citizen comments on livestock populations. The septic failure (Human) numbers in Table 4.2 were taken from the VDH-DSS Sanitary Surveys for Richardson and Totuskey Creeks in 2005.

Table 4.2 Domestic Animals and Septic Systems *observed* contributing pollution for Richardson, and Totuskey Creeks (Based on observations by TMDL staff and comments from public meetings. Sanitary violation numbers (Human) were taken from the VDH Sanitary Survey)

Fecal Coliform Sources	Totuskey and Richardson Creeks
Treatment facilities (human)	3
Septic (human)	3
Cattle	309
Dogs	40
Horses	13
Donkey	2
Goats	28
Chicken	20
Sheep	2
Goose	1
Peacock	1
llama	1

Calculations for population estimates of livestock, pets and wildlife are shown in Table 4.4. The method used to calculate these population estimates is found in Appendix B and data are supplied by VIMS and DGIF. Records provided by the Richmond County Treasurer's office cited 1369 individual dog licenses and 162 kennel licenses sold in 2009 (as of 8/20/09). These records are available upon request from the Richmond County Treasurers Offices.

Table 4.3 Livestock, pet and wildlife population *calculated estimates* for individual and collective watersheds (calculated values from sub-watersheds within Richardson and Totuskey Creeks in Appendix B)

Creek	Cattle	Chickens	Horses	Dogs	Deer	Raccoons	Ducks	Geese
Totuskey Creek	454	4	8	628	1198	1888	791	589
Richardson Creek	250*	0	1	85	174	262	291	217
Total for Collective Watershed	704	4	9	713	1372	2150	1082	806

* supplied by stakeholder at first public meeting.

Biosolids & Poultry Litter Applications

A search of permitted biosolids land-applications by land-applier within the watersheds of Totuskey and Richardson Creeks was conducted. Several records of land-applied biosolids permits for farms within the watershed were found. There were four (4) farm tracts containing multiple fields that applied biosolids in the collective watershed between 2001 and 2008 according to DEQ records. The tract site codes are VA RI 00003, VA RI 00017, VA RI 00031, and VA RI 00037. See Table C.2 for amount of wet tons applied per month and year in the watershed. The total amount of biosolids applied from 2001 through 2008 in the watershed was 5399.16 wet tons.

Biosolids are also referred to as sewage sludge, which are the solid, semisolid, or liquid materials removed during the treatment of domestic sewage in a treatment facility. Biosolids include, but are not limited to, solids removed during primary, secondary, or advanced wastewater treatment, scum, domestic septage, portable toilet pumpings, Type III marine sanitation device pumpings, and sewage sludge products. When properly treated and processed, sewage sludge become "biosolids" which can be safely recycled and applied as fertilizer to improve and maintain productive soils and stimulate plant growth. When properly applied and disked in prior to the next significant rainfall, DEQ has not found biosolids to contribute excessive bacterial loads to surface waters. Beginning January 1, 2008 the Virginia Department of Environmental Quality (DEQ) assumed regulatory oversight of all land application of biosolids.

A search was conducted for records of poultry litter transport and storage within Richmond County. There were no litter transfer records found for the Richmond County area.

4.4 Bacterial Source Tracking

Bacterial Source tracking is used to identify sources of fecal contamination from humans as well as domestic and wild animals. The BST method used in Virginia is based on the premise that *Escherichia coli (E. Coli)* found in humans, domestic and wild animals will have significantly different patterns of resistance to a variety of antibiotics. The Antibiotic Resistance Analysis (ARA) uses fecal streptococcus or *E. coli* and patterns of antibiotic resistance for separation of sources of the bacterial contribution. The BST analysis used for this TMDL classified the bacteria into one of four source categories: human, pets, livestock, and wildlife. However, BST analysis is an inexact technique that is still under evaluation and error exists in correctly assigning *E. coli* isolates to the appropriate fecal sources. BST is a general tool for making a broad determination of bacterial source, therefore BST percentages should not be considered precise.

The BST sampling period was October 2004 through September 2005. The target sampling interval was once monthly. The location of BST stations were chosen by VDH. Table 4.4 shows the summary of all BST monitoring stations for Richardson and Totuskey Creeks growing areas. Table 4.5 shows BST for Richardson Creek station 25-17 and Table 4.6 shows BST for Totuskey Creek station 25-3. For each station where BST was collected, BST percentages were weighted by the number of isolates, concentration, and volume. Thus the higher the number of isolates, concentration, and volume; the more weight an individual sample was given in calculating the BST source percentages. Table 4.7 shows the weighted average BST for Richardson Creek, Table 4.8 shows the weighted average BST for Totuskey Creek, The respective BST pie charts for these two Creeks are shown in Figures 4.4 and 4.5, and a combined Totuskey / Richardson Creeks BST pie chart is Figure 4.6.

The BST shows that for Richardson Creek the largest percentage sources were human and wildlife (30%), followed by livestock at 28%, and pet at 12%. In Totuskey Creek, livestock was the dominant source at 49%, followed by wildlife at 28%, human at 12%, and pet at 11%. These values were used as a tool to help determine the source allocations in deriving the Total Maximum Daily Loads for Richardson and Totuskey Creeks.

Table 4.4 Summary of Bacterial Source Tracking Samples for Totuskey and Richardson Creeks

Station ID	Growing Area	HUP	County	Impairment	# Plates Received
25-17	25	E24	Richmond	Richardson Creek	12
25-3	25	E24	Richmond	Totuskey Creek	12

BOLD type indicates a statistically significant value.
NVI – No viable isolates.

Table 4.5 Bacterial Source Tracking results for Richardson Creek at Station 25-17.

Station ID	Date of Sample	Number of Isolates	*E. coli* Concentration	Wildlife	Human	Livestock	Pet
25-17	10/21/2004	24	150	**33%**	**59%**	4%	4%
25-17	11/4/2004	24	150	4%	**71%**	0%	**25%**
25-17	12/6/2004	24	93	**29%**	**38%**	**21%**	**12%**
25-17	1/4/2005	24	43	**38%**	8%	12%	**42%**
25-17	2/2/2005	24	35	**38%**	**46%**	4%	**12%**
25-17	3/16/2005	16	2.9	0%	12%	**44%**	**44%**
25-17	4/14/2005	24	9.1	12%	**50%**	**21%**	**17%**
25-17	5/16/2005	24	23	12%	8%	**17%**	**63%**
25-17	6/13/2005	24	290	**84%**	8%	0%	8%
25-17	7/14/2005	24	1100	**21%**	**29%**	**38%**	**12%**
25-17	8/10/2005	24	460	**29%**	**25%**	**38%**	8%
25-17	9/8/2005	24	93	4%	**25%**	**71%**	0%

BOLD type indicates a statistically significant value.
NVI – No viable isolates.

Table 4.6 Bacterial Source Tracking results for Totuskey Creek at Station 25-3.

Station ID	Date of Sample	Number of Isolates	*E. coli* Concentration	Wildlife	Human	Livestock	Pet
25-3	10/21/2004	24	93	**38%**	**33%**	8%	**21%**
25-3	11/4/2004	23	39	**13%**	**83%**	0%	4%
25-3	12/6/2004	24	93	12%	**25%**	**21%**	**42%**
25-3	1/4/2005	10	2.9	**40%**	20%	20%	20%
25-3	2/2/2005	20	2.9	**35%**	**40%**	10%	**15%**
25-3	3/16/2005	14	9.1	0%	**21%**	0%	**79%**
25-3	4/14/2005	24	43	**33%**	**17%**	**25%**	**25%**
25-3	5/16/2005	24	15	12%	**17%**	**33%**	**38%**
25-3	6/13/2005	24	43	**38%**	4%	**41%**	**17%**
25-3	7/14/2005	24	460	**29%**	**21%**	**38%**	**12%**
25-3	8/10/2005	24	1200	**38%**	**12%**	**38%**	**12%**
25-3	9/8/2005	24	1100	**17%**	4%	**75%**	4%

Table 4.7 Isolate, Concentration, and Volume Weighted Average BST for Richardson Creek by Type

Condemnation Area	Livestock	Wildlife	Human	Pet
025-071A Richardson Creek	28%	30%	30%	12%

Table 4.8 Isolate, Concentration, and Volume Weighted Average BST for Totuskey Creek by Type

Condemnation Area	Livestock	Wildlife	Human	Pet
025-071A Totuskey Creek	49%	28%	12%	11%

Table 4.9 Isolate, Concentration, and Volume Weighted Average BST for Totuskey and Richardson Creeks by Type

Condemnation Area	Livestock	Wildlife	Human	Pet
025-071A Totuskey & Richardson Creeks	45%	28%	16%	11%

Figure 4.4 Richardson Creek and Tributaries Weighted BST by Source Type

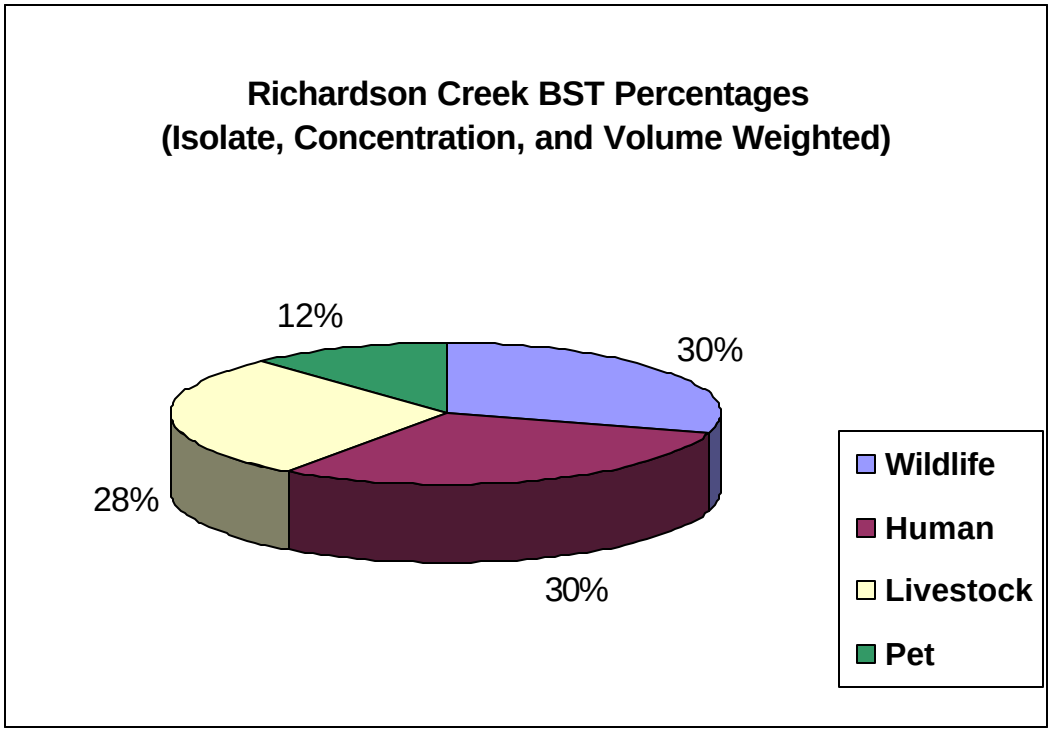


Figure 4.5 Totuskey Creek and Tributaries Weighted BST by Source Type

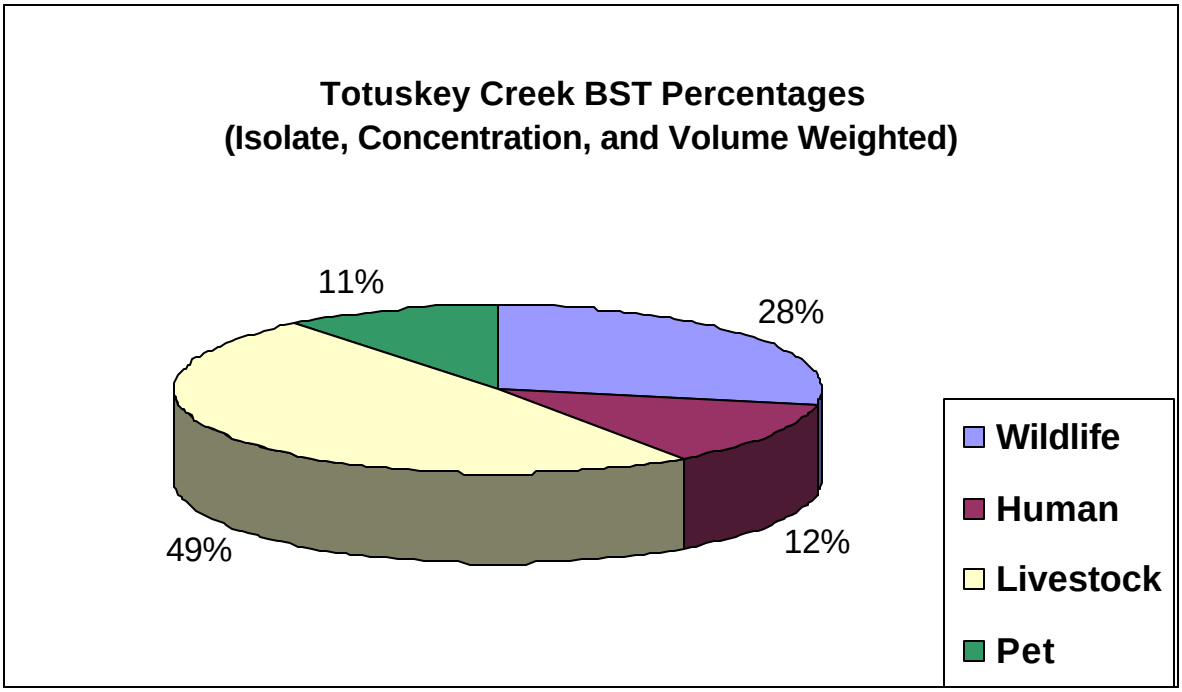
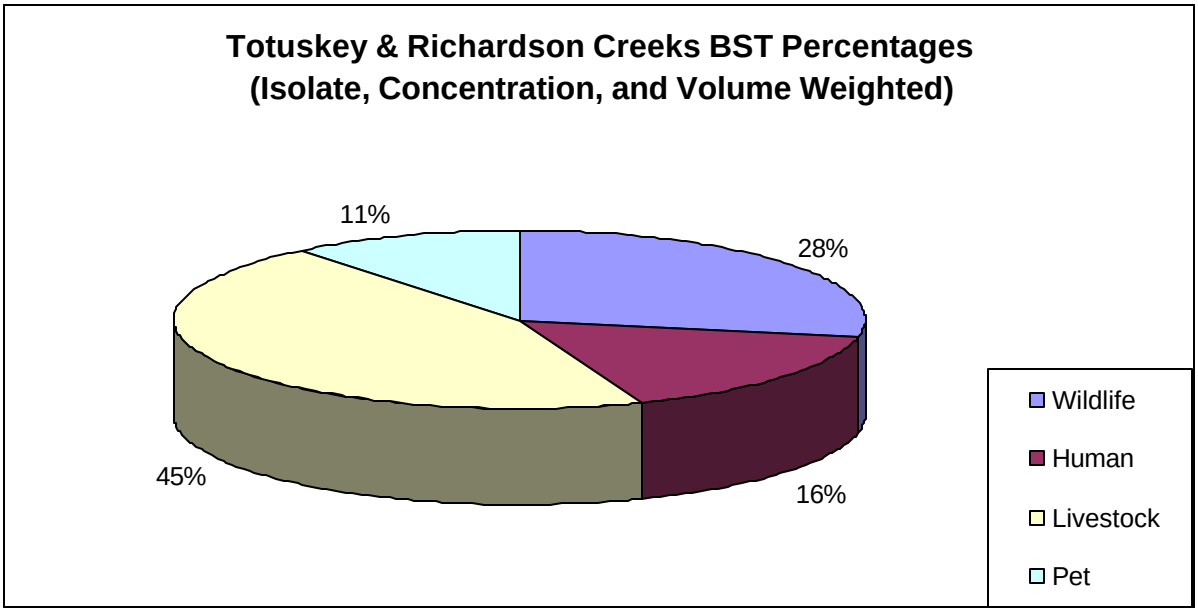


Figure 4.6 Totuskey and Richardson Creeks and Tributaries Weighted BST by Source Type



5.0 TMDL Development

Virginia DEQ and the Virginia Department of Health collaborated to use a simplified volumetric approach to develop the TMDL. The procedure uses bathymetric data to estimate estuarine volumes and BST data and land use to determine the load reductions for each of the four sources of fecal coliform bacteria needed to attain the water quality criteria.

5.1 TMDL Calculation

To meet the water quality standards for both geometric mean and 90th percentile criteria, TMDLs for the impaired segments in the watershed are defined for the geometric mean load and the 90th percentile load. The TMDL for the geometric mean essentially represents the allowable average limit and the TMDL for the 90th percentile is the allowable upper limit. If observed data were available for more than one monitoring station in a condemned area, the volume-weighted values for each condemned area were used to represent the embayment concentration.

A. Current Fecal Coliform Condition

The fecal coliform concentration in an embayment varies due to the changes in biological, hydrological and meteorological conditions. The current condition was determined based on the 30-sample geometric mean and 90th percentile of fecal coliform values of each condemned area multiplied by the volume. The monitoring data for the period of record for each station was used to determine the current condition. Data were collected by VDH-DSS from 1984 -2008 for the oldest stations. The maximum values for the period of record for geometric mean and 90th percentile multiplied by the volume were used to represent the current loads. Therefore, the current loads represent the worst case scenario observed.

B. Geometric Mean Analysis:

The current geometric mean load was estimated using the worst case 30-sample geometric mean

multiplied by the estuarine volume determined by bathymetry. The allowable load was calculated using the water quality standard of 14 MPN/100ml multiplied by the volume. The load reduction needed for the attainment of the water quality standard was determined by subtracting the allowable load from the current load and dividing by the current load (shown in Table 5.7A). The process may be described by the equation as follows. The geometric mean results are listed in Table 5.0.

The geometric mean load reduction is estimated as follows:

Geometric Mean Value (max geomean # MPN/100ml) x (volume) = Current Load

Criteria Value (14 MPN/100ml) x (volume) = Allowable Load

$$\text{Load Reduction} = \frac{\text{Current Load} - \text{Allowable Load}}{\text{Current Load}} \times 100\ \%$$

Table 5.0 Geometric Mean Analysis of Current Load & Allowable Load Growing Area 025-071 Section A

Condemnation Area	Volume (m^3)	Geometric Mean Fecal Coliform (MPN/100ml)	Geometric Mean W.Q. Standard Fecal Coliform (MPN/100ml)	MOS	Current Load (MPN/day)	TMDL Allowable Load (MPN/day)
Totuskey & Richardson Creeks Section A	8048533	100.29	14	Implicit	8.07E+12	1.13E+12

C. 90th Percentile Analysis

The current 90th percentile concentration load was estimated using the worst case 30-sample 90th percentile concentration multiplied by the estuarine volume determined by bathymetry. The allowable load was calculated using the water quality standard of 49 MPN/100ml multiplied by the volume. The load reduction needed for the attainment of the water quality standard was determined by subtracting the allowable load from the current load and dividing by the current load (shown in Table 5.7B). The process may be described by the equation as follows. The 90th percentile concentration results are listed in Table 5.1.

The 90th percentile load reduction is estimated as follows:

90th percentile concentration (max 90th %ile # MPN/100ml) x (volume) = Current Load

Criteria Value (49 MPN/100ml) x (volume) = Allowable Load

$$\text{Load Reduction} = \frac{\text{Current Load} - \text{Allowable Load}}{\text{Current Load}} \times 100\ \%$$

Table 5.1 90th Percentile Analysis of Current Load and Allowable Load Growing Area 025-071 Section A

Condemnation Area	Volume (m^3)	90th Percentile Fecal Coliform (MPN/100ml)	90th Percentile W.Q. Standard Fecal Coliform (MPN/100ml)	MOS	Current Load (MPN/day)	TMDL Allowable Load (MPN/day)
Totuskey & Richardson Creeks Section A	8048533	887.65	49	Implicit	7.14E+13	3.94E+12

D. Recreational Impairment Analysis

The instantaneous enterococci water quality standard is used to determine attainment of the recreational (primary contact) designated use. The following language is excerpted from the 2008 Final Water Quality Assessment Guidance Manual:

> The enterococci instantaneous standard 104 per 100 ml applies when 2 or more samples per month are not available to calculate a geometric mean. Where data are not sufficient to calculate a geometric mean, at least two exceedences and >10.5% of the total single samples taken during the assessment period exceeding the instantaneous maximum bacteria standard for primary contact recreation is impaired.

VDEQ collected enterococci bacterial samples in Totuskey Creek at four different station locations. The recreational use current load for Totuskey Creek (E24E-02-BAC) was estimated volumetrically by the following equation:

Maximum Single Highest Enterococci Value x Volume = Current Load

The recreational use allowable load for Totuskey Creek (E24E-02-BAC) is estimated volumetrically by the following equation:

Enterococci instantaneous standard Value x Volume = Allowable Load (TMDL)

The highest recorded enterococci value for Totuskey Creek occurred at two monitoring stations. One at Little Totuskey Creek station 3-LIK000.15, where enterococcus was measured at values greater than 2000 cfu/100mL on May 27, 2009. The other station where this value occurred was station 3-TOT006.34 where enterococci was measured at values greater than 2000 cfu/100mL on July 23, 2009 as seen in Table 5.2.

Table 5.2 Summary of Monitoring Data for Enterococci at Totuskey Creek

Station ID	Period of Record	Bacteria Constituent	Total Observations	Minimum (cfu/100 mL)	Maximum (cfu/100 mL)	Primary Contact Violation Rate
3-TOT005.11	7/2003 to 7/2009	*Enterococci*	34	25	1100	38%
3-LIK000.15	1/2009 to 7/2009	*Enterococci*	7	25	2000	43%
3-TOT006.34	1/2009 to 7/2009	*Enterococci*	7	25	2000	43%
3-MAY000.12	1/2009 to 7/2009	*Enterococci*	6	25	350	17%

The load reduction for the instantaneous standard is calculated utilizing a similar approach as used for the shellfish reductions:

$$\frac{\text{Current Load}_{max} - \text{Allowable Load}}{\text{Current Load}_{max}} = \text{Load Reduction}$$

The results for these calculations are shown in Tables 5.3, 5.6, and 5.7C.

Table 5.3 Analysis of Current Load & Allowable Load Recreation Use Impairment in Totuskey Creek*

Condemnation Area	Total Load Allocation (LA)	Total Waste Load Allocation (WLA)	Current Load (MPN/day)	Margin of Safety (MOS)	TMDL Allowable Load (MPN/day)
Totuskey & Richardson Creeks	3.94E+12	2.41E+08	7.14E+13	Implicit	3.94E+12

* See Section 5.2A For WLA . Calculation

5.2 Load Allocation

A comparison of the reductions based on geometric mean load and on the 90th percentile load shows that the 90th percentile load is the critical condition. The 90th percentile criterion is most frequently exceeded. Therefore the 90th percentile loading is used to allocate source contributions and establish load reduction targets among the various contributing sources that will yield the necessary water quality improvements to attain the water quality standard.

The percent loading for each of source category is based on BST source assessment of the watershed and the land use. These percentages are used to determine where load reductions are needed. The loadings for each source are determined by multiplying the total current and allowable loads by the representative percentage. The percent reduction needed to attain the water quality standard or criterion is allocated to each source category. This is shown in Table 5.4 for Totuskey and Richardson Creeks. These tables are created to fulfill the TMDL requirements by ensuring that the criterion is attained.

Table 5.4 Shellfish TMDL Reductions/Allocations based upon 90th Percentile Standard: Totuskey and Richardson Creeks

Condemnation Area	Fecal Type	BST Allocation % of Total Load	Current Load MPN / day	Load Allocation MPN / day	Reduction Needed
Totuskey & Richardson Creeks 025-071A	Wildlife	28%	2.00E+13	3.94E+12	80.3%
	Human	16%	1.14E+13	0.00E+00	100%
	Livestock	45%	3.21E+13	0.00E+00	100%
	Pets	11%	7.85E+12	0.00E+00	100%
	Total	**100%**	**7.14E+13**	**3.94E+12**	**95%**

The TMDL seeks to eliminate 100% of the human derived fecal component regardless of the allowable load determined through the load allocation process. Human derived fecal coliforms are a serious

concern in the estuarine environment and discharge of human waste is precluded by state and federal law. According to the preceding analysis in Table 5.4, maximum reductions of the controllable loads (e.g. human, livestock, or pets) will be necessary to achieve the water quality standard for the condemnation area. Through an iterative implementation of actions to reduce the controllable loads, subsequent monitoring may indicate that no further reductions are necessary or that revisions in implementation strategies may be appropriate. Continued violations may result in the process of Use Attainment Analysis (UAA) for the waterbody (see Chapter 6 for a discussion of UAA). The allocations presented demonstrate how the TMDL could be implemented to achieve water quality standards; however, the state reserves the right to allocate differently, as long as consistency with the achievement of water quality standards is maintained.

A. Development of Wasteload Allocations

There are two permitted dischargers for bacteria in the watershed, one is the Town of Warsaw WWTP (VA0026891) and the other is the Haynesville Correctional Center WWTP (VA0023469). The facilities' waste load allocation (WLA) is based on the maximum daily design flow multiplied by the Geometric Mean standard for the shellfish harvest use. For the Town of Warsaw WWTP with a design flow of 0.3 MGD, a WLA of 1.61E+08 is assigned for this facility and the Haynesville Correctional Center WWTP with a maximum design flow of 0.15 MGD, resulted in a WLA of 8.03E+07. The facility WLAs are shown in Table 5.5 below for the shellfish impairment.

Table 5.5 Waste Load Allocations for permitted bacteria dischargers (shellfish impairment).

Facility Name	Design Flow (MGD)	Design Flow (mL/D)	Fecal Coliform Permit Limit Geometric Mean (MPN/100ml)	Facility Daily Load (MPN/Day)	Future Growth Factor of 1% (MPN/Day)	Total *Annual* Load (MPN/Year)	Total *Daily* WLA (Future growth +Daily load) (MPN/Day)
Town of Warsaw WWTP (VA0026891)	0.3	1.41E+09	14	1.59E+08	1.59E+06	5.87E+10	1.61E+08
Haynesville Correctional Facility (VA0023469)	0.15	5.68E+08	14	7.95E+07	7.95E+05	2.93E+10	8.03E+07
						Total WLA	**2.41E+08**

In addition to developing WLAs for the shellfish impairment, WLAs were also developed for these facilities for the recreation impairment. The WLA for the recreation use is calculated similarly as for the shellfish impairment with the exception that a different indicator organisim and water quality criteria are used. Enterococci is the indicator organism used by DEQ to determine recreation use impairments in tidal waterways and the geometric mean water quality standard for Enterococci is 35 (cfu/100ml). The WLA calculations of the recreation use for each facility are below in Table 5.6.

Table 5.6 Waste Load Allocations for permitted bacteria dischargers (recreation impairment).

Facility name	Design Flow (MGD) Outfall	Design Flow (mL/D)	Enterococci Permit Limit Geometric Mean (cfu/100ml)	Facility Daily Load (cfu/100ml)	Future Growth Factor of 1% (cfu/100ml)	Total Daily Load + Future Growth Factor of 1% (cfu/Day)	Total *Annual* Load (cfu/Year)	Total *Daily* WLA (Future growth + Daily load) (cfu/Day)
Town of Warsaw WWTP (VA0026891)	0.3	1.14E+09	35	3.97E+08	3.97E+06	4.01E+08	1.47E+11	4.01E+08
Hyanesville Correctional Center Facility (VA0023469)	0.15	5.68E+08	35	1.99E+08	1.99E+06	2.01E+08	7.33E+10	2.01E+08
							Total Daily WLA	**6.02E+08**

5.3 Consideration of Critical Conditions and Seasonal Variation

EPA regulations at 40 CFR 130.7 (c)(1) require TMDLs to take into account critical conditions for stream flow, loading, and water quality parameters. The intent of this requirement is to ensure that the water quality of the waterbody is protected during times when they are most vulnerable.

Critical conditions are important because they describe the factors that combine to cause a violation of water quality standards and will help in identifying the actions that may have to be undertaken to meet water quality standards. The current loading to the waterbody was determined using a long-term record of water quality monitoring (observation) data. The period of record for the data was 1984 to 2008. The resulting estimate is quite robust.

A comparison of the geometric mean values and the 90th percentile values against the water quality criteria will determine which represents the more critical condition or higher percent reduction. If the geometric mean values dictate the higher reduction, this suggests that, on average, water sample counts are consistently high with limited variation around the mean. If the 90th percentile criterion requires a higher reduction, this suggests an occurrence of the high fecal coliform due to the variation of hydrological conditions. For this study, the 90th percentile criterion is the most critical condition. Thus, the final load reductions determined using the 90th percentile represent the most stringent conditions and it is the reductions based on these bacterial loadings that will best yield attainment of the water quality standard. Seasonal variations involve changes in surface runoff, stream flow, and water quality as a result of hydrologic and climatologic patterns. Variations due to changes in the hydrologic cycle as well as temporal variability in fecal coliform sources, such as migrating duck and goose populations, are accounted for by the use of the long-term data record to estimate the current load.

5.4 Margin of Safety

A Margin of Safety (MOS) is required as part of a TMDL in recognition of uncertainties in the understanding and simulation of water quality in natural systems. For example, knowledge is incomplete regarding the exact nature and magnitude of pollutant loads from various sources and the specific impacts of those pollutants on the chemical and biological quality of complex, natural water bodies. The MOS is intended to account for such uncertainties in a manner that is conservative from the standpoint of environmental protection. A MOS is either numeric or implicit in the design of the TMDL. In this TMDL the MOS is implicit in the conservative assumptions used in the load calculations, such as using the worst case bacterial concentrations in current load calculations, resulting in the highest and most protective percent reductions.

5.5 TMDL Summary

To meet the water quality standards for both geometric mean and 90th percentile criteria, the TMDL for the two creeks must be defined for both the geometric mean load and the 90th percentile load, as required by USEPA. A future growth factor of 1% of the total TMDL was included as a Waste Load Allocation to cover future construction of waste treatment facilities. The TMDLs for each creek are summarized in the Tables 5.7A, 5.7B, and 5.7C.

Table 5.7A TMDL Summary for Closures in the Totuskey and Richardson Creeks Watershed (geometric mean)(Fecal Coliform)

Condemnation Area	Total Load Allocation (LA) (MPN/Day)	Total Waste Load Allocation (LA) (MPN/Day)	Current Load (MPN/Day)	TMDL Allowable Load (MPN/Day)	Margin of Safety	Required Reduction
Totuskey & Richardson Creeks	1.13E+12	2.41E+08	8.07E+12	1.13E+12	Implicit	86%

Table 5.7B TMDL Summary for Closures in the Totuskey and Richardson Creeks Watershed (90th percentile) (Fecal Coliform)

Condemnation Area	Total Load Allocation (LA) (MPN/Day)	Total Waste Load Allocation (WLA) (MPN/Day)	Current Load (MPN/day)	TMDL Allowable Load (MPN/day)	Margin of Safety (MOS)	Required Reduction
Totuskey & Richardson Creeks	3.94E+12	2.41E+08	7.14E+13	3.94E+12	Implicit	95%

Table 5.7C TMDL Summary of the Recreation Impairment in Totuskey Creek (Enterococci)

Impaired Water body Segment	Total Load Allocation (LA) (cfu/Day)	Total Waste Load Allocation (WLA) (cfu/Day)	Current Load (cfu/day)	TMDL Allowable Load (cfuday)	Margin of Safety (MOS)	Required Reduction
Totuskey Creek	5.30E+12	6.02E+08	1.02E+14	5.30E+12	Implicit	95%

6.0 TMDL Implementation

The goal of the TMDL program is to establish a three-step path that will lead to attainment of water quality standards. The first step in the process is to develop TMDLs that will result in meeting water quality standards. This report represents the culmination of that effort for the bacteria impairments in the Totuskey and Richardson Creeks watersheds. The second step is to develop a TMDL implementation plan. The final step is to implement the TMDL implementation plan and to monitor water quality to determine if water quality standards are being attained.

Following approval of a TMDL report by EPA, measures should be taken to reduce pollution levels in the waterbody. These measures, which can include the use of better treatment technology, the installation of best management practices (BMPs) and designation of No Discharge Zones (NDZ), are implemented in an iterative process that is described along with specific BMPs in the implementation plan. The process for developing an implementation plan has been described in the recent "TMDL Implementation Plan Guidance Manual", published in July 2003 and available upon request from the DEQ and DCR TMDL project staff or at http://www.deq.state.va.us/tmdl/implans/ipguide.pdf . With successful completion of implementation plans, Virginia will be well on the way to restoring impaired waters and enhancing the value of this important resource. Additionally, development of an approved implementation plan will improve a locality's chances for obtaining financial and technical assistance during implementation.

6.1 Staged Implementation

In general, Virginia intends for the required reductions to be implemented in an iterative process that first addresses those sources with the largest impact on water quality. For example, in agricultural areas of the watershed, the most promising management practice is livestock or horse exclusion from waterbodies. This has been shown to be very effective in lowering fecal coliform concentrations in waterbodies, both by reducing the fecal deposits themselves and by providing additional riparian buffer to the stream. Other remedial measures which should be considered in these watersheds are pasture management and manure composting facilities.

Protecting existing riparian zones is an inexpensive way to reduce runoff to the impaired water-bodies and will reduce the input of bacteria. The Chesapeake Bay Act requires 100 feet of riparian buffer area around Bay watersheds. Education programs for water-front owners in both urban and rural settings along these streams regarding the importance of maintaining riparian buffers would be beneficial.

In both urban and rural areas, reducing the human fecal loading from failing septic systems should be a primary implementation focus because of its health implications. This component could be implemented through education on septic tank pump-outs as well as a septic system repair/replacement program and the use of alternative waste treatment systems. In sewered areas, reducing the loading from leaking sewer lines could be accomplished through a sanitary sewer inspection and management program.

The loadings contributed by domestic pets may be reduced through pet waste education programs, "Scoop the Poop" stations in public areas where dogs are often walked which feature trash receptacles and baggies for cleaning up after pets, pet waste composters for pet owners and veterinary clinics, and septic systems for kennels.

In waterbodies with significant boat traffic, the designation of a No Discharge Zone may effectively reduce bacterial loads to the impaired segments. A No Discharge Zone in the Lynnhaven River in Virginia Beach, VA., resulted in portions of the estuary being re-opened for shellfish harvesting for the first time in over 70 years.

The iterative implementation of BMPs in the watershed has several benefits:

1. It enables tracking of water quality improvements following BMP implementation through follow-up monitoring;

2. It provides a measure of quality control, given the uncertainties inherent in TMDL loading calculations.

3. It provides a mechanism for developing public support through periodic updates on BMP implementation and water quality improvements;

4. It helps ensure that the most cost effective practices are implemented first; and

5. It allows for the evaluation of the adequacy of the TMDL in achieving water quality standards.

Watershed stakeholders will have opportunity to participate in the development of the TMDL implementation plan. Specific goals for BMP implementation will be established as part of the implementation plan development.

6.2 Link to ongoing Restoration Efforts

Implementation of this TMDL will contribute to on-going water quality improvement efforts aimed at restoring water quality in the Chesapeake Bay. Tributary strategies have been developed for state-wide water quality improvements and for the Chesapeake Bay. Up-to-date information on tributary strategy development can be found at http://www.snr.state.va.us/Initiatives/WaterQuality/. There are also local organizations such as the Northern Neck Land Conservancy, Northumberland Association of Progressive Stewardship, in addition to the Northern Neck Soil and Water Conservation District (SWCD – a conservation partner of DCR). These groups will be especially helpful during the IP phase in order to form partnerships to facilitate communication regarding on-going water-quality improvement efforts and reductions in bacteria levels.

6.3 Reasonable Assurance for Implementation

A. Follow-Up Monitoring

VDH-DSS will continue sampling at the established bacteriological monitoring stations in accordance with its shellfish monitoring program. VADEQ will continue to use data from these monitoring stations and related ambient monitoring stations to evaluate improvements in the bacterial community and the effectiveness of TMDL implementation in attainment of the general water quality standard.

B. Regulatory Framework

While section 303(d) of the Clean Water Act and current EPA regulations do not require the development of TMDL implementation plans as part of the TMDL process, they do require reasonable assurance that the load and wasteload allocations can and will be implemented. Additionally, Virginia's 1997 Water Quality Monitoring, Information and Restoration Act (WQMIRA or the "Act") directs the State Water Control Board to "develop and implement a plan to achieve fully supporting status for impaired waters" (Section 62.1-44.19.7). The Act also establishes that the implementation plan shall include the date of expected achievement of water quality objectives, measurable goals, corrective actions necessary and the associated costs, benefits and environmental impacts of addressing the impairments. EPA outlines the minimum elements of an approvable implementation plan in its 1999 "Guidance for Water Quality-Based Decisions: The TMDL Process." The listed elements include implementation actions/management measures, timelines, legal or regulatory controls, time required to attain water quality standards, monitoring plans and milestones for attaining water quality standards.

Once developed, DEQ intends to incorporate the TMDL implementation plan into the appropriate Water Quality Management Plan (WQMP), in accordance with the Clean Water Act's Section 303(e). In response to a Memorandum of Understanding (MOU) between EPA and DEQ, DEQ also submitted a draft Continuous Planning Process to EPA in which DEQ commits to regularly updating the WQMPs. Thus, the WQMPs will be, among other things, the repository for all TMDLs and TMDL implementation plans developed within a river basin.

C. Implementation Funding Sources

One potential source of funding for TMDL implementation is Section 319 of the Clean Water Act. Other funding sources for implementation include the U.S. Department of Agriculture's Conservation Reserve Enhancement and Environmental Quality Incentive Programs, the Virginia State Revolving Loan Program, the Virginia Agricultural Best Management Practices Cost Share Program, the Chesapeake Bay Restoration Fund, the Virginia Environmental Endowment, the National Fish and Wildlife Foundation, and the Virginia Water Quality Improvement Fund. The TMDL Implementation Plan Guidance Manual contains additional information on funding sources, as well as government

agencies that might support implementation efforts and suggestions for integrating TMDL implementation with other watershed planning efforts.

D. Addressing Wildlife Contributions

In some waters for which TMDLs have been developed, water quality source identification indicates that even after removal of all of the sources of bacteria (other than wildlife), the stream may not attain standards under all flow regimes at all times. **However, neither the Commonwealth of Virginia nor EPA is proposing the elimination of wildlife to allow for the attainment of water quality standards.** This is obviously an impractical and wholly undesirable action. While managing over-populations of wildlife remains as an option to local stakeholders, the reduction of wildlife or changing of a natural background condition is not the intended goal of a TMDL.

Based on the above, EPA and Virginia have developed a TMDL strategy to address the wildlife issue. The first step in this strategy is to develop a reduction goal. The pollutant reductions for the interim goal are applied only to controllable, anthropogenic sources identified in the TMDL, setting aside any control strategies for wildlife. During the first implementation phase all controllable sources would be reduced to the maximum extent practicable using the staged approach outlined above. Following completion of the first phase, DEQ would re-assess water quality in the stream to determine if the water quality standard is attained. This effort will also evaluate if the technical assumptions were correct.

If water quality standards are not being met, a special study called a Use Attainability Analysis (UAA) may be initiated to reflect the presence of naturally high bacteria levels due to uncontrollable sources. The outcomes of the UAA may lead to the determination that the designated use(s) of the waters may need to be changed to reflect the attainable use(s). To remove a designated use, the state must demonstrate 1) that the use is not an existing use, 2) that downstream uses are protected, and 3) that the source of bacterial contamination is natural and uncontrollable by effluent limitations and by implementing cost-effective and reasonable best management practices for non-point source control (9 VAC 25-260-10). All site-specific criteria or designated use changes must be adopted as amendments to the water quality standards regulations. Watershed stakeholders and EPA will be able to provide comment during this process. Additional information can be obtained at http://www.deq.state.va.us/wqs/WQS03AUG.pdf

7.0 Public Participation

During development of the TMDL for the Totuskey and Richardson Creeks watersheds, public involvement was encouraged through a public participation process that included public meetings and stakeholder meetings.

The first technical advisory committee and public meetings were held on May 6, 2009. A basic description of the TMDL process and the agencies involved was presented and a discussion was held regarding the source assessment input, bacterial source tracking, and load calculations. Public understanding of and involvement in the TMDL process was encouraged. Input from these meetings was utilized in the development of the TMDL and improved confidence in the allocation scenarios and TMDL process. There was one public comment received. The TMDL load allocations were presented during the second public meeting held on September 9, 2009. There was 1 public comment received. The public meetings were advertised in the local media, signs advertising the meeting were placed at high access road intersections in the watershed for two weeks before the meeting, and email invitations were sent to local government and stakeholders.

8.0 Glossary

303(d). A section of the Clean Water Act of 1972 requiring states to identify and list water bodies that do not meet the states' water quality standards.

Allocations. That portion of receiving water's loading capacity attributed to one of its existing or future pollution sources (nonpoint or point) or to natural background sources. (A wasteload allocation [WLA] is that portion of the loading capacity allocated to an existing or future point source, and a load allocation [LA] is that portion allocated to an existing or future nonpoint source or to natural background levels. Load allocations are best estimates of the loading, which can range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting loading.)

Ambient water quality. Natural concentration of water quality constituents prior to mixing of either point or nonpoint source load of contaminants. Reference ambient concentration is used to indicate the concentration of a chemical that will not cause adverse impact on human health.

Anthropogenic. Pertains to the [environmental] influence of human activities.

Bacteria. Single-celled microorganisms. Bacteria of the coliform group are considered the primary indicators of fecal contamination and are often used to assess water quality.

Bacterial source tracking (BST). A collection of scientific methods used to track sources of fecal contamination.

Best management practices (BMPs). Methods, measures, or practices determined to be reasonable and cost-effective means for a landowner to meet certain, generally nonpoint source, pollution control needs. BMPs include structural and nonstructural controls and operation and maintenance procedures.

Biosolids. Also known as Sewage sludge, is the name for the solid, semisolid, or liquid materials removed during the treatment of domestic sewage in a treatment facility. Biosolids include, but are not limited to, solids removed during primary, secondary, or advanced wastewater treatment, scum, domestic septage, portable toilet pumpings, Type III marine sanitation device pumpings, and sewage sludge products. When properly treated and processed, sewage sludge becomes "biosolids" which can be safely recycled and applied as fertilizer to improve and maintain productive soils and stimulate plant growth.

Clean Water Act (CWA). The Clean Water Act (formerly referred to as the Federal Water Pollution Control Act or Federal Water Pollution Control Act Amendments of 1972), Public Law 92-500, as amended by Public Law 96-483 and Public Law 97-117, 33 U.S.C. 1251 et seq. The Clean Water Act (CWA) contains a number of provisions to restore and maintain the quality of the nation's water resources. One of these provisions is section 303(d), which establishes the TMDL program.

Concentration. Amount of a substance or material in a given unit volume of solution; usually measured in milligrams per liter (mg/L) or parts per million (ppm).

Contamination. The act of polluting or making impure; any indication of chemical, sediment, or biological impurities.

Cost-share program. A program that allocates project funds to pay a percentage of the cost of constructing or implementing a best management practice. The remainder of the costs is paid by the producer(s).

Critical condition. The critical condition can be thought of as the "worst case" scenario of environmental conditions in the waterbody in which the loading expressed in the TMDL for the pollutant of concern will continue to meet water quality standards. Critical conditions are the combination of environmental factors (e.g., flow, temperature, etc.) that results in attaining and maintaining the water quality criterion and has an acceptably low frequency of occurrence.

Designated uses. Those uses specified in water quality standards for each waterbody or segment whether or not they are being attained.

Domestic wastewater. Also called sanitary wastewater, consists of wastewater discharged from residences and from commercial, institutional, and similar facilities.
Drainage basin. A part of a land area enclosed by a topographic divide from which direct surface runoff from precipitation normally drains by gravity into a receiving water. Also referred to as a watershed, river basin, or hydrologic unit.
Existing use. Use actually attained in the waterbody on or after November 28, 1975, whether or not it is included in the water quality standards (40 CFR 131.3).
Fecal Coliform. Indicator organisms (organisms indicating presence of pathogens) associated with the digestive tract.
Geometric mean. A measure of the central tendency of a data set that minimizes the effects of extreme values.
GIS. Geographic Information System. A system of hardware, software, data, people, organizations and institutional arrangements for collecting, storing, analyzing and disseminating information about areas of the earth. (Dueker and Kjerne, 1989)
Infiltration capacity. The capacity of a soil to allow water to infiltrate into or through it during a storm.
Interflow. Runoff that travels just below the surface of the soil.
Loading, Load, Loading rate. The total amount of material (pollutants) entering the system from one or multiple sources; measured as a rate in weight per unit time.
Load allocation (LA). The portion of a receiving waters loading capacity attributed either to one of its existing or future nonpoint sources of pollution or to natural background sources. Load allocations are best estimates of the loading, which can range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading. Wherever possible, natural and nonpoint source loads should be distinguished (40 CFR 130.2(g)).
Loading capacity (LC). The greatest amount of loading a water body can receive without violating water quality standards.
Margin of safety (MOS). A required component of the TMDL that accounts for the uncertainty about the relationship between the pollutant loads and the quality of the receiving water body (CWA section 303(d)(1)©). The MOS is normally incorporated into the conservative assumptions used to develop TMDLs (generally within the calculations or models) and approved by EPA either individually or in state/EPA agreements. If the MOS needs to be larger than that which is allowed through the conservative assumptions, additional MOS can be added as a separate component of the TMDL (in this case, quantitatively, a TMDL = LC = WLA + LA + MOS).
Mean. The sum of the values in a data set divided by the number of values in the data set.
Monitoring. Periodic or continuous surveillance or testing to determine the level of compliance with statutory requirements and/or pollutant levels in various media or in humans, plants, and animals.
Narrative criteria. Non-quantitative guidelines that describe the desired water quality goals.
Nonpoint source. Pollution that originates from multiple sources over a relatively large area. Nonpoint sources can be divided into source activities related to either land or water use including failing septic tanks, improper animal-keeping practices, forest practices, and urban and rural runoff.
Numeric targets. A measurable value determined for the pollutant of concern, which, if achieved, is expected to result in the attainment of water quality standards in the listed waterbody.
Point source. Pollutant loads discharged at a specific location from pipes, outfalls, and conveyance channels from either municipal wastewater treatment plants or industrial waste treatment facilities. Point sources can also include pollutant loads contributed by tributaries to the main receiving water waterbody or river.
Pollutant. Dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt, and industrial, municipal, and agricultural waste discharged into water. (CWA section 502(6)).

Pollution. Generally, the presence of matter or energy whose nature, location, or quantity produces undesired environmental effects. Under the Clean Water Act, for example, the term is defined as the man-made or man-induced alteration of the physical, biological, chemical, and radiological integrity of water.

Poultry Litter. A material used as bedding in poultry operations. Common litter materials are wood shavings, sawdust, peanut hulls, shredded sugar cane, straw, and other dry, absorbent, low-cost organic materials. After use, the litter consists primarily of poultry manure, but also contains the original litter material, feathers, and spilled feed.

Privately owned treatment works. Any device or system that is (a) used to treat wastes from any facility whose operator is not the operator of the treatment works and (b) not a publicly owned treatment works.

Public comment period. The time allowed for the public to express its views and concerns regarding action by EPA or states (e.g., a Federal Register notice of a proposed rule-making, a public notice of a draft permit, or a Notice of Intent to Deny).

Publicly owned treatment works (POTW). Any device or system used in the treatment (including recycling and reclamation) of municipal sewage or industrial wastes of a liquid nature that is owned by a state or municipality. This definition includes sewers, pipes, or other conveyances only if they convey wastewater to a POTW providing treatment.

Raw sewage. Untreated municipal sewage.

Receiving waters. Creeks, streams, rivers, lakes, estuaries, ground-water formations, or other bodies of water into which surface water and/or treated or untreated waste are discharged, either naturally or in man-made systems.

Riparian areas. Areas bordering streams, lakes, rivers, and other watercourses. These areas have high water tables and support plants that require saturated soils during all or part of the year. Riparian areas include both wetland and upland zones.

Riparian zone. The border or banks of a stream. Although this term is sometimes used interchangeably with floodplain, the riparian zone is generally regarded as relatively narrow compared to a floodplain. The duration of flooding is generally much shorter, and the timing less predictable, in a riparian zone than in a river floodplain.

Runoff. That part of precipitation, snowmelt, or irrigation water that runs off the land into streams or other surface water. It can carry pollutants from the air and land into receiving waters.

Septic system. An on-site system designed to treat and dispose of domestic sewage. A typical septic system consists of a tank that receives waste from a residence or business and a drain field or subsurface absorption system consisting of a series of percolation lines for the disposal of the liquid effluent. Solids (sludge) that remain after decomposition by bacteria in the tank must be pumped out periodically.

Sewer. A channel or conduit that carries wastewater and storm water runoff from the source to a treatment plant or receiving stream. Sanitary sewers carry household, industrial, and commercial waste. Storm sewers carry runoff from rain or snow. Combined sewers handle both.

Slope. The degree of inclination to the horizontal. Usually expressed as a ratio, such as 1:25 or 1 on 25, indicating one unit vertical rise in 25 units of horizontal distance, or in a decimal fraction (0.04), degrees (2 degrees 18 minutes), or percent (4 percent).

Stakeholder. Any person with a vested interest in the TMDL development.

Surface area. The area of the surface of a waterbody; best measured by planimetry or the use of a geographic information system.

Surface runoff. Precipitation, snowmelt, or irrigation water in excess of what can infiltrate the soil surface and be stored in small surface depressions; a major transporter of nonpoint source pollutants.

Surface water. All water naturally open to the atmosphere (rivers, lakes, reservoirs, ponds, streams, impoundments, seas, estuaries, etc.) and all springs, wells, or other collectors directly influenced by surface water.

Topography. The physical features of a geographic surface area including relative elevations and the positions of natural and man-made features.
Total Maximum Daily Load (TMDL). The sum of the individual wasteload allocations (WLAs) for point sources, load allocations (LAs) for nonpoint sources and natural Background, plus a margin of safety (MOS). TMDLs can be expressed in terms of mass per time, toxicity, or other appropriate measures that relate to a state's water quality standard.
VADEQ. Virginia Department of Environmental Quality.
VDH. Virginia Department of Health.
Virginia Pollutant Discharge Elimination System (NPDES). The national program for issuing, modifying, revoking and re-issuing, terminating, monitoring, and enforcing permits, and imposing and enforcing pretreatment requirements, under sections 307, 402, 318, and 405 of the Clean Water Act.
Wasteload allocation (WLA). The portion of a receiving waters' loading capacity that is allocated to one of its existing or future point sources of pollution. WLAs constitute a type of water quality-based effluent limitation (40 CFR 130.2(h)).
Wastewater. Usually refers to effluent from a sewage treatment plant. See also **Domestic wastewater**.
Wastewater treatment. Chemical, biological, and mechanical procedures applied to an industrial or municipal discharge or to any other sources of contaminated water to remove, reduce, or neutralize contaminants.
Water quality. The biological, chemical, and physical conditions of a waterbody. It is a measure of a waterbody's ability to support beneficial uses.
Water quality criteria. Levels of water quality expected to render a body of water suitable for its designated use, composed of numeric and narrative criteria. Numeric criteria are scientifically derived ambient concentrations developed by EPA or states for various pollutants of concern to protect human health and aquatic life. Narrative criteria are statements that describe the desired water quality goal. Criteria are based on specific levels of pollutants that would make the water harmful if used for drinking, swimming, farming, fish production, or industrial processes.
Water quality standard. Law or regulation that consists of the beneficial designated use or uses of a waterbody, the numeric and narrative water quality criteria that are necessary to protect the use or uses of that particular waterbody, and an antidegradation statement.
Watershed. A drainage area or basin in which all land and water areas drain or flow toward a central collector such as a stream, river, or lake at a lower elevation.
WQIA. Water Quality Improvement Act.

9.0 Citations

Bacterial Source Tracking Analyses to Support Virginia's TMDLs: Shellfish Stations. December 2004. Map Tech Inc. in cooperation with New River Highlands RC & D. Blacksburg, Virginia

US EPA Shellfish Workshop Document (2002).

VA DEQ 1998 303(d) List of Impaired Waters.

10.0 Appendices

Appendix A Growing Area 025 Shoreline Sanitary Survey and Condemnation Notices

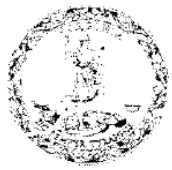
Appendix B Supporting Documentation and Watershed Assessment

Appendix C Water Quality Data

Appendix D 1) Code of Virginia §62.1-194.1 Obstructing or contaminating state waters.

2) 33 CFR Volume 2, Parts 120 to 199. Revised as of July 1, 2000

Appendix A:



COMMONWEALTH of VIRGINIA

Department of Health

P O BOX 2448

RICHMOND, VA 23218

TDD 1-800-828-1120

NOTICE AND DESCRIPTION OF SHELLFISH AREA CONDEMNATION NUMBER 71, TOTUSKEY AND RICHARDSON CREEKS

EFFECTIVE 3 NOVEMBER 1998

Pursuant to Title 28.2, Chapter 8, §§28.2-803 through 28.2-808, §32.1-20, and §9-6.14:4.1, B.16 of the *Code of Virginia*:

1. The "Notice and Description of Shellfish Area Condemnation Number 71, Totuskey and Richardson Creeks," effective 31 October 1997, is cancelled effective 3 November 1998.

2. Condemned Shellfish Area Number 71, Totuskey and Richardson Creeks, is established, effective 3 November 1998, and shall consist of areas A and B described below. As to area A, it shall be unlawful for any person, firm, or corporation to take shellfish from this area, for any purpose, except by permit granted by the Marine Resources Commission, as provided in Section 28.2-810 of the *Code of Virginia*. As to area B, it shall be unlawful for any person, firm or corporation to take shellfish from this area, for any purpose. The boundaries of the area are shown on map titled "Totuskey and Richardson Creeks, Condemned Shellfish Area No. 71, 3 November 1998" which is part of this notice.

3. The Department of Health will receive, consider and respond to petitions by any interested person at any time with respect to reconsideration or revision of this order.

BOUNDARIES OF CONDEMNED AREA NUMBER 71

A. The condemned area shall include all of Richardson and Totuskey Creeks lying upstream of a line drawn from a point located 700 yards northeasterly along the shore from the southernmost tip of Accaceek Point to Neals Point and downstream of a line drawn due east from navigational aid G "27."

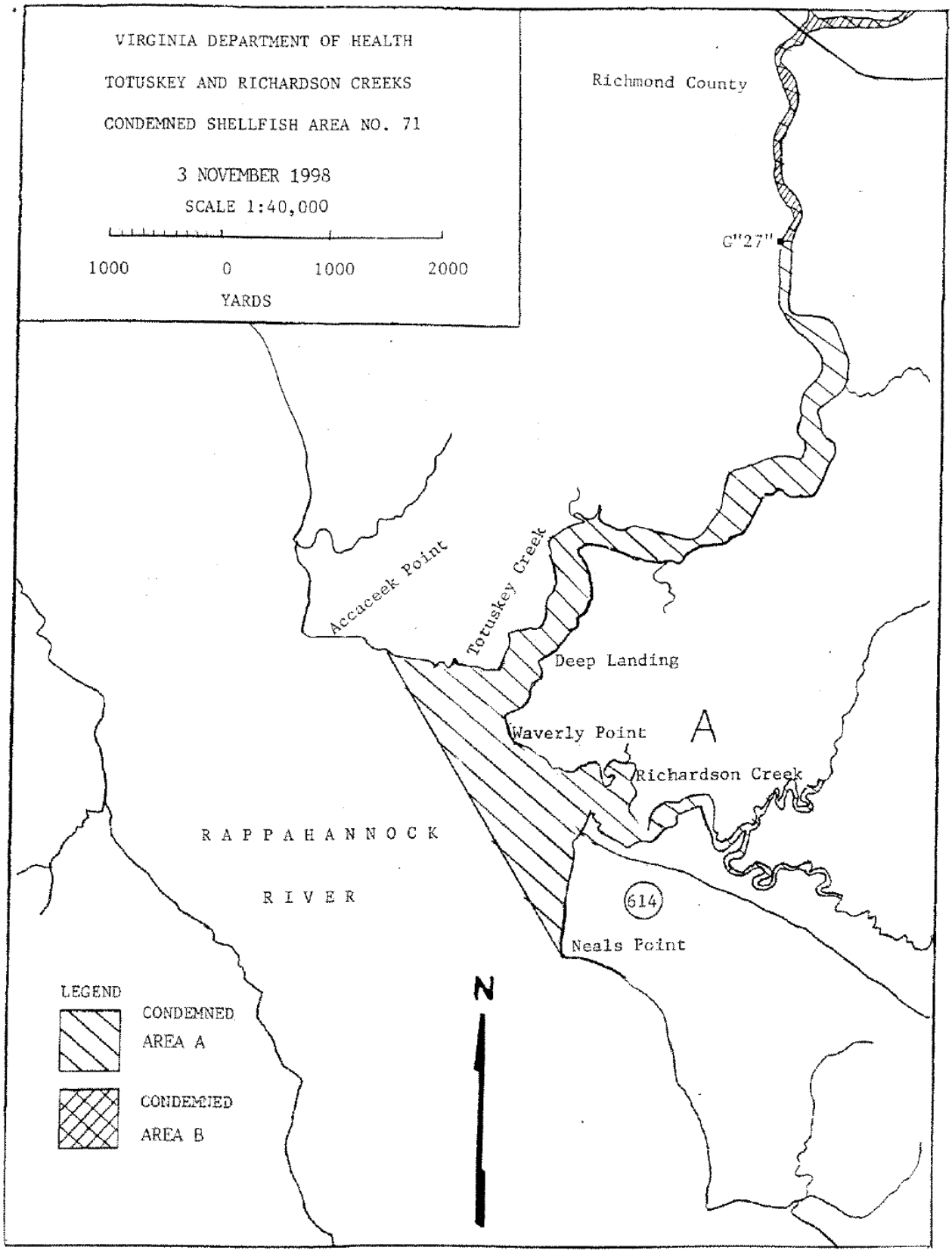
B. The condemned area shall include all of Totuskey Creek lying upstream of a line drawn due east from navigational aid G "27."

Recommended by: _____
Director, Division of Shellfish Sanitation

Ordered by: C.W. Thorpe M.D. 10-21-98
Acting State Health Commissioner Date

VDH VIRGINIA DEPARTMENT OF HEALTH
Protecting You and Your Environment

SIGNED PURSUANT TO AUTHORITY VESTED IN DEPUTY COMMISSIONER BY §2.1-20.01:2, CODE OF VA


VIRGINIA DEPARTMENT OF HEALTH
TOTUSKEY AND RICHARDSON CREEKS
CONDEMNED SHELLFISH AREA NO. 71
3 NOVEMBER 1998
SCALE 1:40,000
1000 0 1000 2000
YARDS
Richmond County
G"27"
Accaceek Point
Totuskey Creek
Deep Landing
Waverly Point
A
Richardson Creek
RAPPAHANNOCK
RIVER
614
Neals Point
N
LEGEND
CONDEMNED
AREA A
CONDEMNED
AREA B

REGISTRAR OF REGULATIONS

07 MAR -6 PM 2:09

COMMONWEALTH of VIRGINIA

Department of Health
DIVISION OF SHELLFISH SANITATION
109 Governor Street, Room 614-B
Richmond, VA 23219
Ph: 804-864-7487
Fax: 804-864-7481

NOTICE AND DESCRIPTION OF SHELLFISH AREA CONDEMNATION NUMBER 025-071, TOTUSKEY AND RICHARDSON CREEKS

EFFECTIVE 16 MARCH 2007

Pursuant to Title 28.2, Chapter 8, §§28.2-803 through 28.2-808, §32.1-20, and §9-6.14:4.1, B.16 of the *Code of Virginia*:

1. The "Notice and Description of Shellfish Area Condemnation Number 025-071, Totuskey and Richardson Creeks," effective 4 October 2005, is cancelled effective 16 March 2007.

2. Condemned Shellfish Area Number 025-071, shown as Sections A and B, is established, effective 16 March 2007. As to Section A, it shall be unlawful for any person, firm, or corporation to take shellfish from this area for any purpose, except by permit granted by the Marine Resources Commission, as provided in Section 28.2-810 of the *Code of Virginia*. As to Section B, it shall be unlawful for any person, firm or corporation to take shellfish from this area, for any purpose. The boundaries of these areas are shown on the map titled "Totuskey and Richardson Creeks, Condemned Shellfish Area Number 025-071, 16 March 2007" which is part of this notice.

3. The Department of Health will receive, consider and respond to petitions by any interested person at any time with respect to reconsideration or revision of this order.

BOUNDARIES OF CONDEMNED AREA NUMBER 025-071

A. The condemned area shall include all of Totuskey and Richardson Creeks and their tributaries lying upstream of a line drawn between latitude/longitude map coordinate (37°52'43.2", -76°45'55.4"), map coordinate (37°51'32.5",-76°45'09.9"), and map coordinate (37°51'15.5", -76°44'25.3"); but excluding the area defined as Section B.

B. The condemned area shall include that portion of Totuskey Creek and it's tributaries lying upstream of a line drawn between latitude/longitude map coordinate (37°54'26.8", -76°43'20.1") and map coordinate (37°54'26.7",-76°43'17.1").

Recommended by: _____
Director, Division of Shellfish Sanitation

Ordered by: _____ 03/05/2007
State Health Commissioner Date

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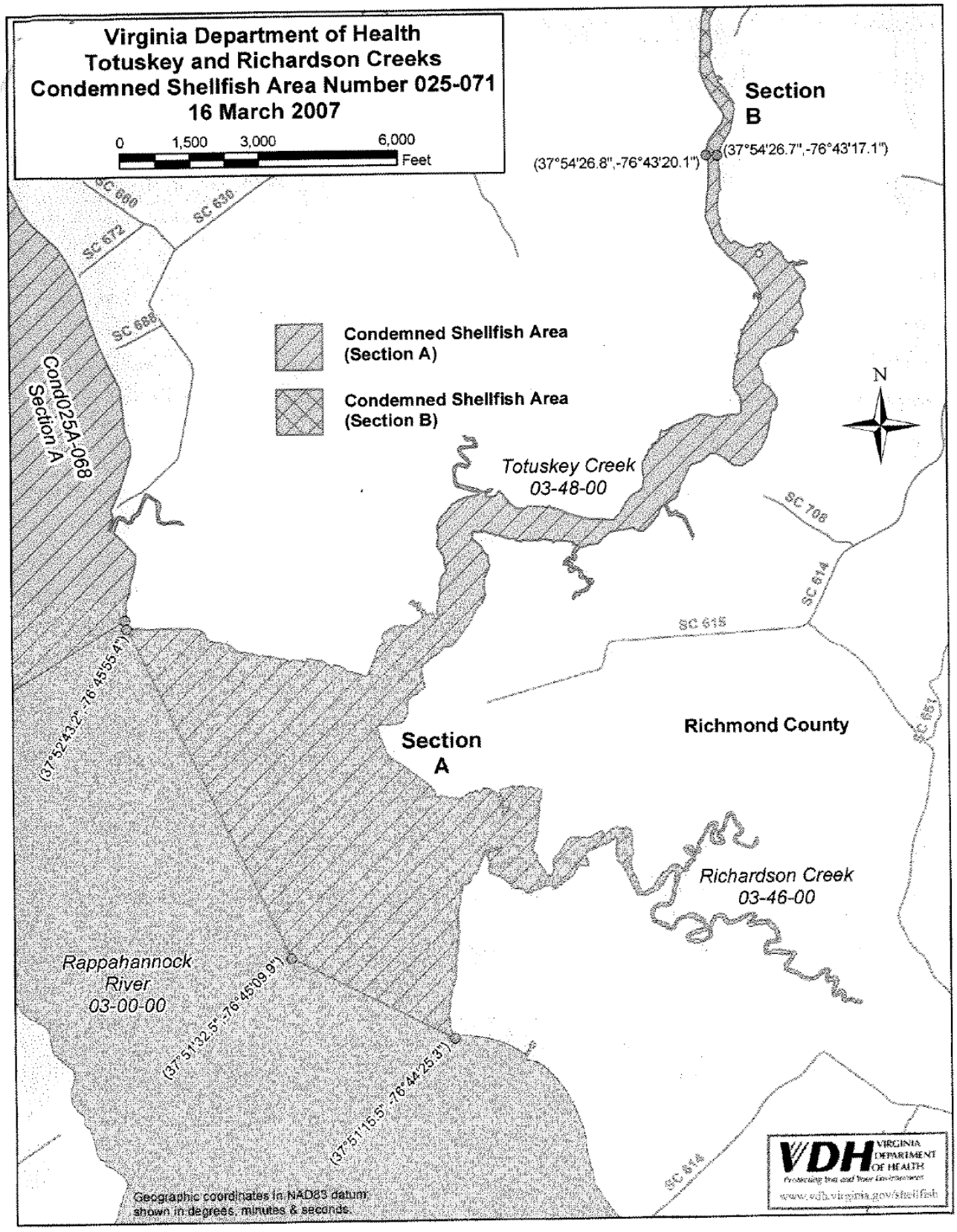
Virginia Department of Health
Totuskey and Richardson Creeks
Condemned Shellfish Area Number 025-071
16 March 2007
0 1,500 3,000 6,000
Feet
Section B
(37°54'26.8",-76°43'20.1")
(37°54'26.7",-76°43'17.1")
SC 660
SC 630
SC 672
SC 688
Condemned Shellfish Area (Section A)
Condemned Shellfish Area (Section B)
Cond025A-068 Section A
N
Totuskey Creek 03-48-00
SC 708
SC 614
SC 615
(37°52'43.2",-76°45'55.4")
Section A
Richmond County
SC 651
Richardson Creek 03-46-00
Rappahannock River 03-00-00
(37°51'32.5",-76°45'09.9")
(37°51'16.5",-76°44'25.3")
SC 614
Geographic coordinates in NAD83 datum, shown in degrees, minutes & seconds.
VDH VIRGINIA DEPARTMENT OF HEALTH
www.vdh.virginia.gov/shellfish

COMMONWEALTH of VIRGINIA
Department of Health
DIVISION OF SHELLFISH SANITATION
109 Govenor Street, Room 614-B
Richmond, VA 23219

Ph: 804-864-7487
Fax: 804-864-7481

TOTUSKEY AND RICHARDSON CREEKS
Growing Area # 025
Richmond County

Date: September 16, 2005
Survey Period: June 24 – August 29, 2005
Total Number of Properties Surveyed: 670
Surveyed By: D.R. Beuchelt

SECTION A: GENERAL

This survey area extends from Reference Point 25 beginning at Suggetts Point on Route 614, and covers the shoreline and first and second order streams of the Totuskey and Richardson Creeks (within a designated boundary line drawn by the Division of Shellfish Sanitation) ending up on Route 630 at Accaceek Point, Reference Point 25A.

The topography of the area surveyed begins with an elevation of 5' at the shoreline of the Rappahannock River and reaches a maximum of 135' inland. The population is moderate and growing with new communities under development. The economy is based around managerial, professional, sales, and office services. These account for 52.2% of the employment. The town of Warsaw is considered a major commercial hub for the Northern Neck of Virginia. The town has approximately 100 retail businesses.

Meteorological data indicated that 1.26" of rain fell June 24 – 30, 4.46" July 1 – 31, and 3.09" August 1 – 29 for a total rainfall of 8.81" during the survey period.

Found during this survey were three locations classified as Sewage treatment facilities (two of which are located outside of the boundary line with one discharging into the watershed), three on site deficiencies, twelve properties marked as potential deficiencies, six industrial sites (one which is located outside of the boundary line but discharges into the watershed), three solid waste sites, three boating activity sites, and twelve sites marked for animal pollution.

Copies of Bacteriological, Hydrographic and Shellfish Closure data are available at the area office for review. Shellfish closures can be reviewed online by accessing the Division of Shellfish Sanitation site via the Virginia Department of Health website at http://www.vdh.virginia.gov/OEHS/shellfish/.

This report lists only those properties that have a sanitary deficiency or have other environmental significance. "***DIRECT***" indicates that the significant activity or deficiency has a direct impact on shellfish waters. Individual field forms with full information on properties listed in this report are on file in the Richmond office of the Division of Shellfish Sanitation and are available for reference until superseded by a subsequent survey of the area. Data in the report is also made available to local health departments and other agencies to address items that may be out of compliance with their regulatory programs.

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SECTION B: SEWAGE POLLUTION SOURCES

SEWAGE TREATMENT FACILITIES

35. ***DIRECT*** – Warsaw Lagoons Wastewater Treatment Plant, c/o John Slusser, Town Manager, PO Box 730, Warsaw 22572. Population served 1400 – 1500. VDPES Permit No. VA0026891. Design flow is 0.3 MGD. Treatment facility consists of two screening/comminution units, three lined and aerated pond/lagoon units, two sedimentation units, two chlorinators, two sulfonators, flow measurement, one post aeration unit, two sludge pumps, one aerobic digestion unit, *four drying beds (nonfunctional at time of last DEQ inspection), and a rip rap shore based effluent outfall that discharges final effluent into a Tributary of Totuskey Creek.

* The aerobic digester receives sludge until it becomes full, then the sludge is pumped and hauled to the Essex Concrete septage lagoons in Millers tavern. A copy of the most recent OWP/DEQ inspection report is on file with this report in the Division of Shellfish Sanitation Richmond office.

41. ***DIRECT*** – Haynesville Correctional Center Wastewater Treatment Plant and Camp #17 WWTP, c/o Wilson Davis, WWTP Supervisor, PO Box 129, Haynesville 22472. Population served approx.: 1100 - 1125 inmates and 350 staff. VDPES Permit No. VA0023469. Design flow is 0.15 MGD. Haynesville treatment facility consists of flow measurement, four screening/comminution units, two grit removal units, two sequencing batch reactors, four sludge pumps, one aerobic digestion unit, *20 drying bed units, two tertiary filtration units, two ultraviolet disinfection lamp/assemblies, a plant drain lift station and final effluent to Unit #17 WWTP effluent discharge channel.

* Sludge is removed from the drying beds and stored in a lined gondola (on concrete pad) prior to disposal at a BFI landfill. Camp #17 Treatment facility consists of two screening /comminution units, an influent pump station, one flow equalization cell, one activated sludge aeration unit, one sedimentation unit, two sludge pumps, one aerobic digestion unit, * two drying beds, one tertiary filtration unit, one chlorine contact tank, dechorination by bisulfite tablet feed box, one post aeration unit, flow measurement, one post aeration unit (final effluent for Haynesville Correctional Unit and Camp#17), and a effluent /plant shore based outfall for both treatment plants that discharges into a tributary of Garlands Mill Pond.

* Sludge is disposed of at landfill. A copy of the most recent OWP/DEQ inspection report is on file with this report in the Division of Shellfish Sanitation Richmond office.

It is important to note that the Haynesville Correctional Center WWTP and the Camp #17 WWTP are two different facilities, each with their own treatment process; however, as stated above, they share the same discharge outfall unit. The Camp #17 WWTP is proposed to close in 4 years (approx. 2009). All sewage from that facility will then be directed to the Haynesville Correctional Center WWTP.

42. Thomas W. Beasley, Septic Contractor, 5964 Historyland Highway, Farnham 22460.Business-septage disposal site. Physical address of the site is on a gravel road off of Moores Mill Rd. (Rt. 677) which is located off of Canal Rd. (Rt. 607). No Contact. Treatment facility consists of septage lagoons.

ON-SITE DEFICIENCIES

2. NO FACILITIES, Location: 1864 Beaverdam Road, Warsaw 22572. Dwelling – 2 story white siding with light brown trim. No Contact. Appears to be vacant and abandoned. Owner unknown. Information turned over to local health.

5. NO FACILITIES, Location: Forest Road, Warsaw 22572. Dwelling – A series of 5 old camping travel trailers. No Contact. Sanitary Notice issued 6/30/05 to field # 74.

17. CONTRIBUTES POLLUTION – Location: 362 Boswell Road, Warsaw 22572. Dwelling – Gold and white mobile home. 5 persons. Lid on septic tank is broken with a portion of it missing. Sanitary Notice issued 8/22/05 to field # 310. Tax Map #31-162A.

POTENTIAL POLLUTION

3. Location: 1028 Beaverdam Road, Warsaw 22572. Dwelling – 1 story white siding with brown shutters. No Contact. Junk and debris are scattered over premises.

4. Location: 257 Oscar drive, Warsaw 22572. Dwelling – 1 story white vinyl siding with brown shutters and gray shingles. No Contact. Grass is dark over drainfield lines. No evidence of effluent or odor.

7. Location: 286 Sharps Road, Warsaw 22572. Dwelling – blue (multi-colored) mobile home with blue shutters. No Contact. Grass is dark over drainfield lines. No evidence of effluent or odor.

12. Location: 167 The Hook Road, Warsaw 22572. Dwelling – brick rancher with addition. No Contact. Grass is dark over drainfield lines. No evidence of effluent or odor.

18. Location: 82 Boswell Road, Warsaw 22572. Dwelling – 1 story yellow siding with white trim and light gray shingles. No Contact. Grass is tall, dark and thick over septic tank area. No evidence of effluent or odor.

23. Location: Indianfield Road, Warsaw 22572. No dwelling. No contact. Trash and debris is dumped back into the woods as a private dumping ground. Owner unknown. Information is forwarded to the local health department.

26. Location: 52 Lyell Drive, Warsaw 22572. Dwelling – 1 ½ story white cinder block with metal roof and black shutters. No Contact. Grass is tall and dark over drainfield lines. No evidence of effluent or odor.

27. Location: 187 Three Way Road, Warsaw 22572. Dwelling – 1 ½ story beige siding with gray shingles and green shutters. No Contact. Grass over drainfield is dark. No evidence of effluent or odor.

28. Location: 47 & 49 Cole Hill Lane, Warsaw 22572. Dwelling – Duplex with gray siding. No Contact. Grass is dark over drainfield lines. No evidence of effluent or odor.

32. Location: 12367 Historyland Highway, Warsaw 22572. Dwelling – 1 story white with light green shingles. No Contact. Old vehicles and junk is scattered over premises.

33. Location: 12593 Historyland Highway, Warsaw 22572. Dwelling - 1 ½ story white with light gray shingles. 2 persons. Junk and other debris is scattered on property.

36. Location: 1689 Wellfords Wharf Road, Warsaw 22572. Dwelling 1 ½ story yellow siding. 4 persons. Grass is tall over drainfield. No evidence of effluent or odor.

SECTION C: NON-SEWAGE WASTE SITES

INDUSTRIAL WASTES

14. Location: 11549 Historyland Highway, Warsaw 22572. Northern Neck Oil Co., c/o Carroll Pemberton, PO Box 97, Warsaw 22572. Business: fuel distributor and station. 8 employees. On-site were 1 x 20000 gallon fuel oil tank, 1 x 20000 gallon regular gasoline tank, 1 x 12000 gallon Kerosene tank, 1 x 7500 gallon diesel fuel tank, 1 x 6300 gallon premium gasoline tank, and 1 x 4000 gallon clear kerosene tank. The 20000 gallon tanks were surrounded by separate berms. The remaining tanks were enclosed within one berm.

20. Location: 10910 Richmond Road, Haynesville 22472. Royster-Clark Inc., c/o Mark Cockrell. Business – fertilizer supplier. 6 – 8 employees. On-site and surrounded by a dike were 1 x 125000 gallon and 2 x 30000 gallon UAN 32 tanks, 1 x 30000 gallon 11-37-0 tank, 1 x 30000 gallon and 1 x 17000 phosphoric acid tanks, 2 x 25000 gallon aqua ammonia tanks, 3 x 12000 gallon and 1 x 6000 gallon T Gold tanks, 2 x 12000 liquid starter fertilizer tanks, 1 x 3000 gallon zinc tank, 1 x 2500 liquid clay tank, and Bulk pesticides - 1 x 2400 Chemical Bicep II Mag. F.C., 1 x 2400 Chemical Princep 4L, 1 x 2400 Chemical Lumax, 1 x 2400 Chemical Roundup, 1 x 2400 Chemical Gramoxone Max. Runoff from the loading pad is pumped to a holding tank and reused. Also on-site is 1 x 500 gallon gasoline tank and 1 x 500 diesel fuel tank, with out berm.

25. Location: 135 Recycling Road, Warsaw 22572. Richmond County Solid Waste Recycling Convenience Center, c/o Steve Samuels, site manager. Public-waste collection and recycling center. 1 employee. Collects waste oil for recycling. On-site was 1 x 500 gallon tank in berm.

30. Location: 6658 Richmond, Warsaw 22572. Frederick Northup, Inc., c/o Stan Terhune, Business – fuel distributor and BP station. 10 employees. On-site were 2 x 25000 gallon #2 fuel oil tanks, 2 x 15000 gallon #2 fuel oil tanks, 2 x 11500 gallon gasoline tanks, 1 x 11500 gallon diesel fuel tank, 1 x 11500 #2 fuel oil tank, and 2 x 11000 gallon kerosene tanks. Tanks are surrounded by an earthen berm.

34. Location: 13027 Historyland Highway, Warsaw 22572. Richmond County Intermediate School, c/o Mr. Ogle Forrest. On-site were 1 x 1000 gallon and 1 x 250 gallon fuel oil tanks without berm.

37. Location: 171 Fox Hunters Hill Road, Warsaw 22572. Dwelling – 2 story white asbestos shingle siding with dark green shutters. 2 persons. On-site were 1 x 1000 gallon diesel fuel and 3 x 300 gallon gasoline tanks without berm.

40. DIRECT - Location: 15939 Historyland Highway, Warsaw 22572. Wood Preservers, Inc., c/o Mr. William Wright. Business – wood preservation. VPDES Permit No. VA0083127. Process utilizes chromated copper arsenate, copper axole, and Dricon in the preservation process. This facility no longer uses creosote to preserve wood. This facility discharges no process wastewater, but is approved by DEQ to install a test stormwater treatment system to allow treatment of stormwater before it leaves the property. The stormwater will be discharged to tributaries of Totuskey Creek and Clark's Run.

SOLID WASTE DUMPSITES

16. Location: 10508 Historyland Highway, Warsaw 22572. Warsaw Auto Parts plus D & L Automotive, c/o David Weedon. 1 employee. Business – used auto parts. On-site were approx. 250 junk vehicles and other auto parts.

21. Location: 167 Martinsville Lane, Warsaw 22572. c/o Ralph Simmons. 4 persons. Business – old junk yard presently closing down. On-site were scrap parts covering 1 -2 acres.

25. Location: 135 Recycling Road, Warsaw 22572. Richmond County Solid Waste Recycling Convenience Center, c/o Steve Samuels, Attendant. 1 person. Business – County Waste Facility. On-site were 5 dumpsters.

SECTION D: BOATING ACTIVITY

MARINAS

- None -

OTHER PLACES WHERE BOATS ARE MOORED

22. Location: Route 620 on Settlers Landing Road, Warsaw 22572. c/o Gene Huffman. Community pier. No contact. 8 seasonal slips/moorings available. On-site was 1 pleasure boat < 26`. Available are restroom facilities, dump station and solid waste containers. Facility No. 920.

UNDER SURVEILLANCE

15. Location: 374 Creek View Lane, Warsaw 22572. c/o Daniel Bishop. Private dock. This property is currently for sale. On-site was 1 jon boat on shore. Facility No. 916.

31. Location: Woodyard Road, Warsaw 22572. Richmond County Public Landing. (off of Route 705). c/o Richmond County/VDOT/VGIF. Available is an in-out ramp. Facility No. 1162.

SECTION E: CONTRIBUTES ANIMAL POLLUTION

1. ***DIRECT*** -Location: 122 Suggetts Point Road, Warsaw 22572. Dwelling – 2 story white siding with black shutters. 2 persons. Present at time of survey were 200 -250 cows. Manure is left on ground surface. Pasture is ≤ 250 ` from Richardson Creek.

6. Location: 678 Sharps Road, Warsaw 22572. Dwelling – 2 story white siding with blue shutters and metal roof. 3 persons. Present at time of survey were 20 cows, 3 dogs and 2 sheep. Manure is left on ground surface.

8. Location: 7957 Historyland Highway, Warsaw 22572. Dwelling – tan mobile home. 1 person. Present at time of survey were 6 cows, 3 horses, and 1 llama. Manure is left on ground surface.

9. ***DIRECT*** - Location: 8305 Historyland Highway, Warsaw 22572. Dwelling – 2 ½ story white idling with blue shutters. 1 person. Present at time of survey were 5 cows and 1 calf. Pasture is fenced and <50` from a first order stream at 100` elevation of Totuskey Creek. Manure is left on ground surface.

10. ***DIRECT*** – Location: 3946 Folly Neck Road, Warsaw 22572. Dwelling – 1 story white siding. No Contact. Present at time of survey were two goats, roaming free outside of pasture with access to Totuskey Creek. Manure is left on ground surface in pasture.

11. ***DIRECT*** – Location: 787 Cedar Point Road, Warsaw 22572. Dwelling – white with gray trim mobile home. No Contact. Present at time of survey were five dogs in pen and unknown number of dogs in house. Pen was < 25` from the marsh of Totuskey Creek at an elevation of 5 – 10`. Manure disposal unknown.

13. Location: 10605 Historyland Highway, Warsaw 22572. Dwelling – beige with brown trim mobile trim. 5 persons. Present at time of survey were 25 goats, 5 – 10 chickens, 8 cows, and 2 dogs. Manure is left on ground surface.

19. Location: 10982 Richmond Road, Warsaw 22572. Dwelling – Brick rancher. No Contact. Present at time of survey were 5 horses, 5 miniature horses, 2 donkeys and unknown number of cows. Manure is left on ground surface.

29. Location: 674 Cole Hill Lane, Warsaw 22572. Dwelling - 2 story white shingle siding with green and white awnings. No Contact. Present at time of survey were 1 goat, 1 goose, 10 – 12 guinea chickens, 1 peacock, and unknown animal in back fenced area. Manure disposal is unknown.

37. Location: 171 Fox Hunters Hill Road, Warsaw 22572. Dwelling – 2 story white asbestos shingle siding with dark green shutters. 2 persons. Present at time of survey were 10 cows. Manure is left on ground surface.

38. Location: Adjacent to 459 Fox Hunters Hill Road, Warsaw 22572. Cobham Park Hunt Club, c/o Aubrey Sanders. Dwelling – cream colored mobile office. No Contact. Present at time of survey were 20 – 30 hunting dogs. Manure disposal is unknown.

39. Location: 1154 Fox Hunters Hill Road, Warsaw 22572. Dwelling – 2 story white siding with green metal roof. No Contact. Present at time of survey were 9 cows. Manure disposal is unknown.

SUMMARY

Area # 025
TOTUSKEY AND RICHARDSON CREEKS
September 16, 2005

SECTION B: SEWAGE POLLUTION SOURCES

1. SEWAGE TREATMENT FACILITIES

2 – DIRECT - # 35, 41
1 – INDIRECT - # 42
3 – B.1. TOTAL

2. ON-SITE SEWAGE DEFICIENCIES

Correction of deficiencies in this section is the responsibility of the local health department.
0 – CONTRIBUTES POLLUTION, DIRECT – None
1 – CONTRIBUTES POLLUTION, INDIRECT - # 17
0 – CP - (Kitchen or Laundry Wastes), DIRECT – None
0 – CP - (Kitchen or Laundry Wastes), INDIRECT – None
0 – NO FACILITIES, DIRECT – None
2 – NO FACILITIES, INDIRECT - # 2, 5
3 – B.2. TOTAL

3. POTENTIAL POLLUTION

Periodic surveillance of these properties will be maintained to determine any status change.
12 – POTENTIAL POLLUTION -# 3, 4, 7, 12, 18, 23, 26, 27, 28, 32, 33, 36

SECTION C: NON-SEWAGE WASTE SITES

1. INDUSTRIAL WASTE SITES

1 – DIRECT - # 40
6 – INDIRECT - # 14, 20, 25, 30, 34, 37
7 – C.1. TOTAL

2. SOLID WASTE SITES

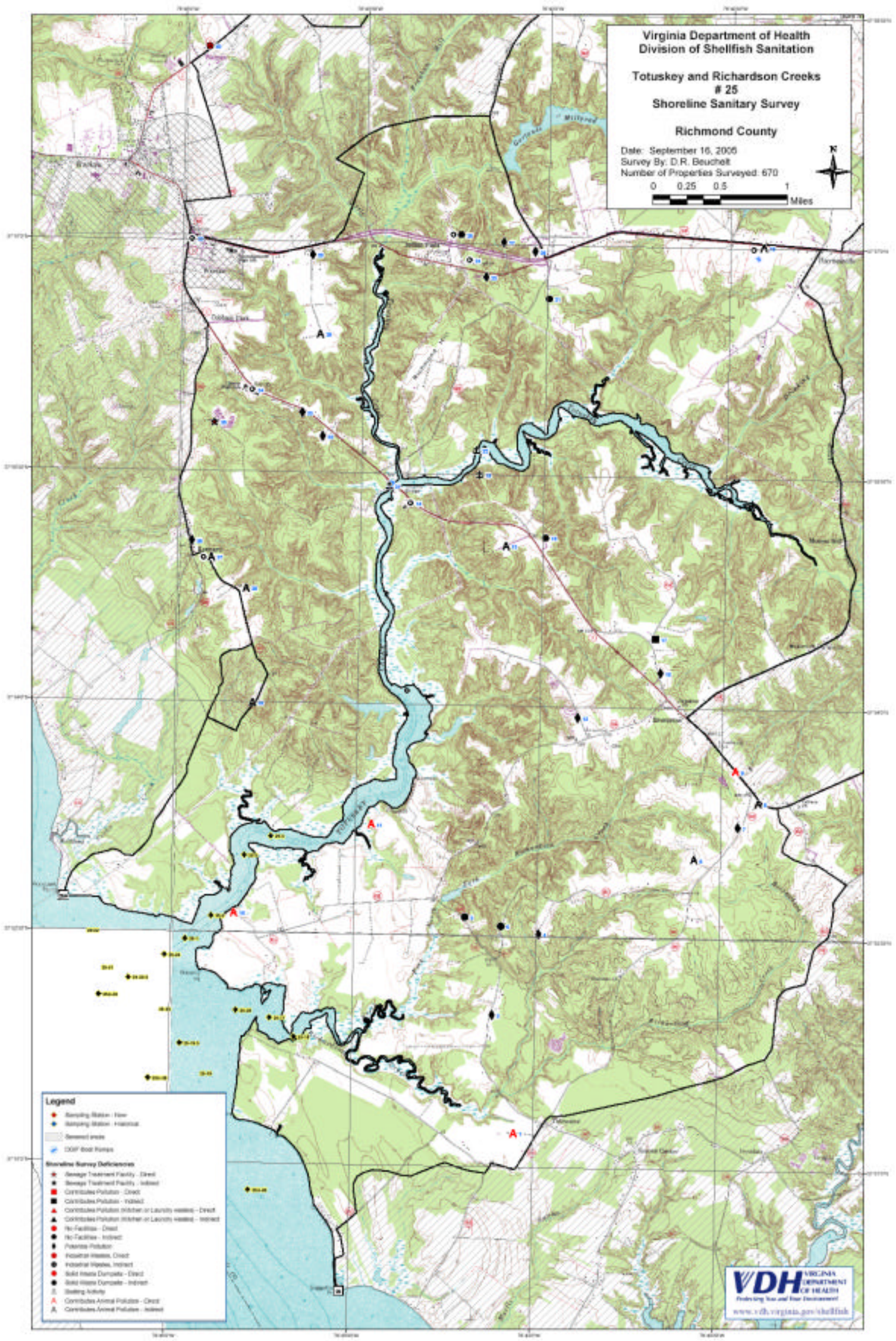
0 – DIRECT – None
3 – INDIRECT - # 16, 21, 25
3 – C.2. TOTAL

SECTION D: BOATING ACTIVITY

0 – MARINAS
1 – OTHER PLACES WHERE BOATS ARE MOORED- # 22
2 – UNDER SURVEILLANCE - # 15, 31
3 – D. TOTAL

SECTION E: CONTRIBUTES ANIMAL POLLUTION

4 – DIRECT - # 1, 9, 10, 11
8 – INDIRECT - # 6, 8, 13, 19, 29, 37, 38, 39
12 – E. TOTAL


Virginia Department of Health
Division of Shellfish Sanitation
Totuskey and Richardson Creeks
25
Shoreline Sanitary Survey
Richmond County
Date: September 16, 2005
Survey By: D.R. Beuchelt
Number of Properties Surveyed: 670
0 0.25 0.5 1
Miles
N
Legend
VDH
VIRGINIA DEPARTMENT OF HEALTH
www.vdh.virginia.gov/shellfish

Appendix B: Supporting Documentation and Watershed Assessment

1. **Fecal Production Literature Review**
2. **Geographic Information System Data: Sources and Process**
3. **Watershed Source Assessment**

Table B.1 Fecal Production Literature Review

	Concentration in feces		Fecal coliform production rate		Comments
	FC/g	Ref.	FC/day (seasonal)	Ref.	
Cat	7.9E+06	1	5.0E+09	4	
Dog	2.3E+07	1	5.0E+09	4	
Chicken	1.3E+06	1	1.9E+08	4	
Chicken			2.4E+08	9	
Cow	2.3E+05	1	1.1E+11	4	average of dairy and beef
Beef cattle			5.4E+09	9	
Deer	1.0E+02	6	2.5E+04	6	assume 250 g/day
Deer	?		5.0E+08	9	best prof. judgment
Duck			4.5E+09	4	average of 3 sources
Duck	3.3E+07	1	1.1E+10	9	
Canada Geese			4.9E+10	4	
Canada Geese	3.6E+04	3	9.0E+06	3	
Canada Geese	1.5E+04	8	3.8E+06	8	assume 250 g/day (3)
Horse			4.2E+08	4	
Pig	3.3E+06	1	5.5E+09	4	
Pig			8.9E+09	9	
Sea Gull	3.7E+08	8	3.7E+09	8	assume 10 g/day
Sea gull			1.9E+09	5	mean of four species
Rabbit	2.0E+01	2	?		
Raccoon	1.0E+09	6	1.0E+11	6	assume 100 g/day
Sheep	1.6E+07	1	1.5E+10	4	
Sheep			1.8E+10	9	
Turkey	2.9E+05	1	1.1E+08	4	
Turkey			1.3E+08	9	
Rodent	1.6E+05	1	?		
Muskrat	3.4E+05	6	3.4E+07	6	
Human	1.3E+07	1	2.0E+09	4	
Septage	4.0E+05	7	1.0E+09	7	assume 70/gal/day/person

1. Geldreich, E. and E. A. Kenner. 1969. Concepts of fecal streptococci in stream pollution. J. Wat. Pollut. Control Fed. 41:R336-R352.

2. Geldreich, E., E. C. Best, B. A. Kenner, and D. J. Van Donsel. 1968. The bacteriological aspects of stormwater pollution. J. Wat. Pollut. Control Fed. 40:1861-1872.
3. Hussong, D., J. M. Damare, R. J. Limpert, W. J. L. Sladen, R. M. Weiner, and R. R. Colwell. 1979. Microbial impact of Canada geese (Branta canadensis) and whistling swans.
4. U.S. Environmental Protection Agency. 2001. Protocol for Developing Pathogen TMDLs. EPA 841-R-00-002. Office of Water (4503F), United States Environmental Protection Agency, Washington, DC. 132 pp.
5. Gould, D. J. and M. R. Fletcher. 1978. Gull droppings and their effects on water quality. Wat. Res. 12:665-672.
6. Kator, H. and M. W. Rhodes. 1996. Identification of pollutant sources contributing to degraded sanitary water quality in Taskinas Creek National Estuarine Research Reserve, Virginia. Special Report in Applied Marine Science and Ocean Engineering No. 336, The College of William and Mary, VIMS/School of Marine Science.
7. Kator, H., and M. W. Rhodes. 1991. Evaluation of Bacteroides fragilis bacteriophage, a candidate human-specific indicator of fecal contamination for shellfish-growing waters. A final report prepared under NOAA Cooperative Agreement NA90AA-H-FD234. Prepared and submitted to NOAA, Southeast Fisheries Science Center, Charleston Laboratory, Charleston, SC. 98 pp.
8. Alderisio, K. A. and N. DeLuca. 1999. Seasonal enumeration of fecal coliform bacteria from the feces of ring-billed gulls (Larus delawarensis) and Canada geese (Branta canadensis). Appl. Environ. Microbiol. 65:5628-5630.
9. TMDL report attributed to Metcalf and Eddy 1991 (Potomac Headwaters of West VA).

Table B.2 GIS Data Elements and Sources

Type of Information	Data Source	Obtained	Reviewed/ Analyzed
Applicable water quality criteria	*Virginia Water Quality Standards*	Yes	Yes
Section 303(d) listings	*VA DEQ*	Yes	Yes
Stream network	*Reach File Version 3 (US EPA BASINS)* *National Hydrography Data (USGS)*	Yes	Yes
Land Use/ Land Cover data	***National Land Cover Data (NLCD) 2001***	Yes	Yes
Soils	*County Level Soil SSURGO data 2001*	Yes	Yes
Digital Elevation Model (DEM)	***BASINS / National Elevation Dataset (!0 meter)***	Yes	Yes
Watershed boundaries	*BASINS, VADEQ* *VIMS Subwatershed Layer*	Yes	Yes
Section 303(d) listed segments	***Virginia Department of Environmental Quality***	Yes	Yes
County Boundaries	***BASINS, ESRI***	Yes	Yes
Roads	***Virginia Department of Transportation***	Yes	Yes
Population/ Household/ Septic System Estimates	***CCRM; VDH-DSS Sanitary Survey, Local VDH,***	Yes	Yes
Wildlife estimates	*VIMS, DGIF*	Yes	Yes
Livestock estimates/ agricultural practices	***USDA National Agricultural Statistics Service, Soil and Water Conservation Districts, VA DCR, VIMS***	Yes	Yes
Combined-sewer and stormwater outfall locations	*VA DEQ, VA DCR* *Local agencies* *VIMS*	Yes	Yes
Pet Estimates	*CCRM; Local County Treasurer License numbers, American Veterinary Medical Association*	Yes	Yes
Marina Estimates	*VIMS , VDH-DSS Sanitary Survey*	Yes	Yes
Monitoring data and station locations	*VDH DSS, Virginia Department of Environmental Quality*	Yes	Yes
Meteorological data	*National Climatic Data Center (NCDC)*	No	No
Tidal Data	*National Oceanic and Atmospheric Administration (NOAA)* *VDH DSS (provided w/ monitoring data)*	Yes	Yes
Stream flow data	*U.S. Geological Survey*	Yes	Yes
Bacteria Source Tracking data (BST)	*VDH-DSS, MapTech*	Yes	Yes
Permitted facility locations and discharge monitoring reports (DMR)	*VA DEQ, VDH*	Yes	Yes

A. GIS Data Description and Process

Watershed boundary determined by VDH, DSS. There are 105 watersheds in Virginia.

Subwatershed boundaries were delineated based on elevation, using digital 7.5 minute USGS topographic maps. There are 1836 subwatersheds.

The original land use has 15 categories that were combined into 3 categories:
urban (high and low density residential and commercial);
undeveloped (forest and wetlands); and
agriculture (pasture and crops).

Descriptions of Shoreline Sanitary Survey deficiencies are found in each report. Contact DSS for more information. Digital data layer generated by CCRM from hardcopy reports.

Wastewater treatment plant locations were obtained from DEQ and digital data layer was generated by CCRM. Design flow, measured flow, and fecal coliform discharges were obtained from DEQ.

Sewers data layer was digitized from Shoreline Sanitary Surveys by CCRM.

Dog numbers were obtained using the database generated by CCRM. The number of issued dog licenses were supplied by the Treasurers office of Richmond County. The number of issued licenses was compared to the calculated estimate values based on watershed.

Domestic livestock includes cows, pigs, sheep, chickens, turkeys, and horses. Database was generated by CCRM.

Wildlife includes ducks and geese, deer, and raccoons. Animals were chosen based on availability of fecal coliform production rates and population estimates. Database was generated by CCRM.
Ducks and geese–US FWS, DGIF
Deer–DGIF
Raccoons–DGIF

Human input was based on DSS sanitary survey deficiencies and US Census Bureau population data (number of households).

Water quality monitoring data are collected, on average, once per month. Digital data layer of locations was generated by DSS. Water quality data was mathematically processed and input into a database.

Water bodies were divided into segments based on the location of the monitoring stations (midway between stations). If a segment contained >1 station, the FC values were averaged. If a segment contained 0 stations, the value from the closest station(s) was assigned to it. Digital data layer of segments was generated by CCRM. FC loadings in the water were obtained by multiplying FC concentrations by segment volume.

Segment volume was determined from current field bathymetry data.

The 1998 303d report was used to set the list of condemnation zones that require TMDLs. The digital data layer was generated by CCRM from hardcopy closure reports supplied by DSS.

B. Population Numbers

The process used to generate population numbers used for the nonpoint source contribution analysis for the four source categories: human, livestock, pets and wildlife is described for each below.

Human:
The number of people contributing fecal coliform from failing septic tanks were developed in two ways and then compared to determine a final value.

1) Deficiencies (septic failures) from the DSS shoreline surveys were counted for each watershed and multiplied by 3 (average number of people per household).
2) Numbers of households in each watershed were determined from US Census Bureau data. The numbers of households were multiplied by 3 (average number of people per household) to get the total number of people and then multiplied by a septic failure rate* to get number of people contributing fecal coliform from failing septic tanks.

*The septic failure rate was estimated by dividing the number of deficiencies in the watershed by the total households in the watershed. The average septic failure rate was 12% and this was used as the default unless the DSS data indicated that septic failure was higher.

Livestock:
US Census Bureau data was used to calculate the livestock values. The numbers for each type of livestock (cattle, pigs, sheep, chickens (big and small), and horses) were reported by county. Each type of livestock was assigned to the land use(s) it lives on, or contributes to by the application of manure, as follows:

Cattle	cropland and pastureland
Pigs	cropland
Sheep	pastureland
Chickens	cropland
Horses	pastureland

GIS was used to overlay data layers for several steps:

1) The county boundaries and the land uses to get the area of each land use in each county. The number of animals was divided by the area of each land use for the county to get an animal density for each county.
2) The subwatershed boundaries and the land uses to get the area of each land use in each subwatershed.
3) The county boundaries and the subwatershed boundaries to get the area of each county in each subwatershed. If a subwatershed straddled more than one county, the areal proportion of each county in the subwatershed was used to determine the number of animals in the subwatershed.

Using MS Access, for each type of livestock, the animal density by county was multiplied by the area of each land use by county in each subwatershed to get the number of animals in each subwatershed. If more than one county was present in a subwatershed, the previous step was done for each county in the subwatershed, then summed for a total number of animals in the subwatershed. The number of animals in each subwatershed was summed to get the total number of animals in each watershed.

Pets:

US Census Bureau data provided the number of households by county. The number of dogs per county was divided by the area of the county to get a dog density per county. GIS was used to overlay the subwatershed boundaries with the county boundaries to get the area of each county in a subwatershed. If a subwatershed straddled more than one county, the areal proportion of each county in the subwatershed was calculated. Using MS Access, the area of each county in the subwatershed was multiplied by the dog density per county to get the number of dogs per subwatershed. If more than one county was present in a subwatershed, the previous step was done for each county in the subwatershed, then summed for a total number of dogs in the subwatershed. The number of dogs in each subwatershed was summed to get the total number of dogs in each watershed.

Wildlife:

Deer—

The number of deer were calculated using information supplied by DGIF, consisting of an average deer index by county and the formula:

#deer/mi^2 of deer habitat = (-0.64 + (7.74 * average deer index)).

Deer habitat consists of forests, wetlands, and agricultural lands (crop and pasture). GIS was used to overlay data layers for the following steps:

1) The county boundaries and the subwatershed boundaries to get the area of each county in each subwatershed. If a subwatershed straddled more than one county, the areal proportion of each county in the subwatershed was calculated.
2) The subwatershed boundaries and the deer habitat to get the area of deer habitat in each subwatershed.

Using MS Access, number of deer in each subwatershed were calculated by multiplying the #deer/mi^2 of deer habitat times the area of deer habitat. If more than one county was present in a subwatershed, the previous step was done for each county in the subwatershed, then summed for a total number of deer in the subwatershed. The number of deer in each subwatershed was summed to get the total number of deer in each watershed.

Ducks and Geese—

The data for ducks and geese were divided into summer (April through September) and winter (October through March).

Summer

The summer numbers were obtained from the Breeding Bird Population Survey (US Fish and Wildlife Service) and consisted of bird densities (ducks and geese) for 3 regions: the south side of the James

River, the rest of the tidal areas, and the salt marshes in both areas. The number of ducks and geese in the salt marshes were distributed into the other 2 regions based on the areal proportion of salt marshes in them using the National Wetland Inventory data and GIS.

Winter

The winter numbers were obtained from the Mid-Winter Waterfowl Survey (US Fish and Wildlife Service) and consisted of population numbers for ducks and geese in several different areas in the tidal region of Virginia. MS Access was used to calculate the total number of ducks and geese in each area and then these numbers were grouped to match the 2 final regions (Southside and the rest of tidal Virginia) for the summer waterfowl populations. Winter populations were an order of magnitude larger than summer populations.

Data from DGIF showed the spatial distribution of ducks and geese for 1993 and 1994. Using this information and GIS a 250m buffer on each side of the shoreline was generated and contained 80% of the birds. Wider buffers did not incorporate significantly more birds, since they were located too far inland. GIS was used to overlay the buffer and the watershed boundaries to calculate the area of buffer in each watershed. To distribute this information into each subwatershed, GIS was used to calculate the length of shoreline in each subwatershed and the total length of shoreline in the watershed. Dividing the length of shoreline in each subwatershed by the total length of shoreline gives a ratio that was multiplied by the area of the watershed to get an estimate of the area of buffer in each subwatershed. MS Excel was used to multiply the area of buffer in each subwatershed times the total numbers of ducks and geese to get the numbers of ducks and geese in each subwatershed. These numbers were summed to get the total number of ducks and geese in each watershed. To get annual populations, the totals then were divided by 2, since they represent only 6 months of habitation (this reduction underestimates the total annual input from ducks and geese, but is the easiest conservative method to use since there is not a way to incorporate the seasonal differences).

Raccoons—

Estimates for raccoon densities were supplied by DGIF for 3 habitats—wetlands (including freshwater and saltwater, forested and herbaceous), along streams, and upland forests. GIS was used to generate a 600ft buffer around the wetlands and streams, and then to overlay this buffer layer with the subwatershed boundaries to get the area of the buffer in each subwatershed. GIS was used to overlay the forest layer with the subwatershed boundaries to get the area of forest in each subwatershed. MS Access was used to multiply the raccoon densities for each habitat times the area of each habitat in each subwatershed to get the number of raccoons in each habitat in each subwatershed. The number of raccoons in each subwatershed was summed to get the total number of raccoons in each watershed.

C. Watershed Source Assessment

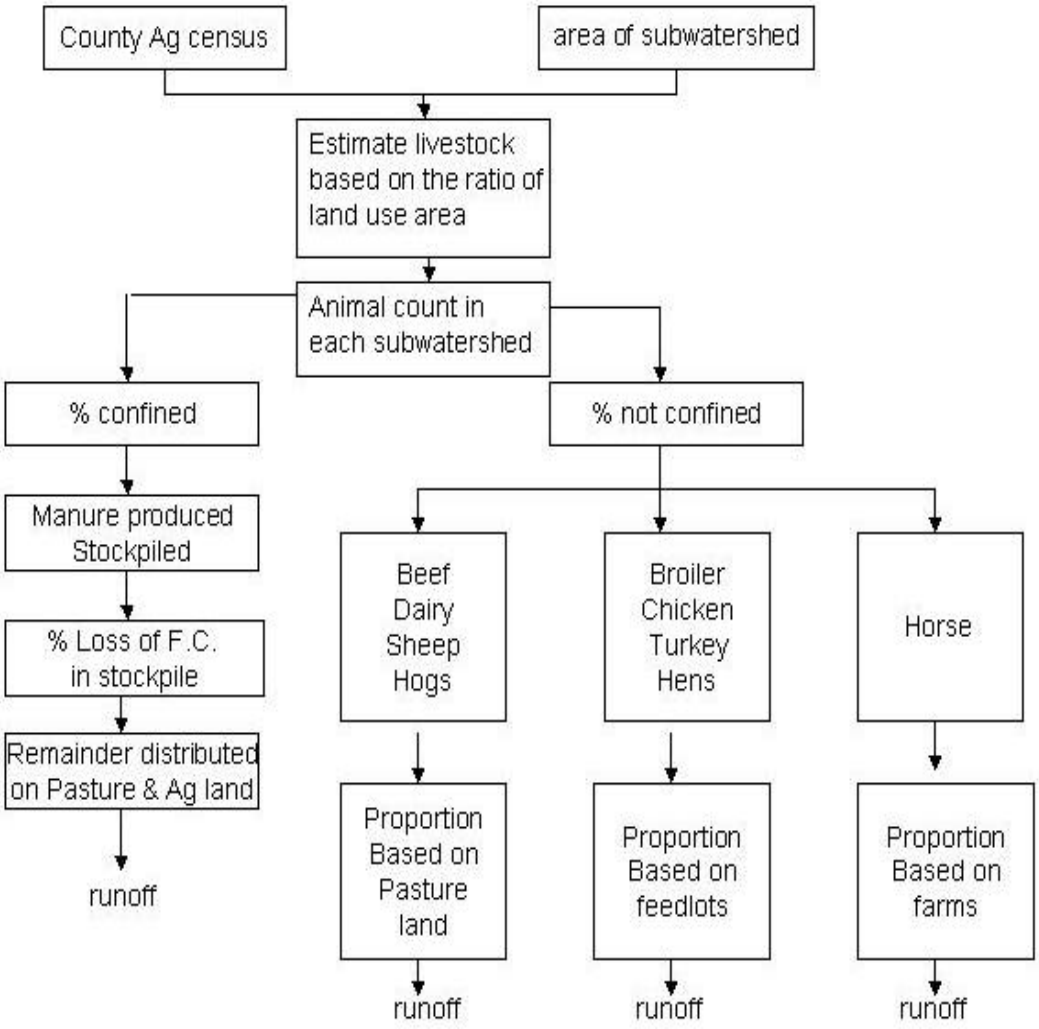
The watershed assessment calculates fecal coliform loads by source based on geographic information system data. A geographic information system is a powerful computer software package that can store large amounts of spatially referenced data and associated tabular information. The data layers produced by a GIS can be used for many different tasks, such as generating maps, analyzing results, and modeling processes. The watershed model requires a quantitative assessment of human sewage sources (i. e., malfunctioning septic systems) and animal (livestock, pets and wildlife) fecal sources distributed within each watershed.

The fecal coliform contribution from livestock is through the manure spreading processes and direct deposition during grazing. This contribution was initially estimated based on land use data and the livestock census data. In the model, manure was applied to both cropland and pasture land depending on the grazing period. Figure B-1 shows a diagram of the procedure for estimating the total number of livestock in the watershed and fecal coliform production. A description of the process used to determine the source population values for wildlife, pets and human used in the calculation of percent loading is found in Appendix B above.

Table B-3 Nonpoint Source Load Distribution by Condemned Area Using Watershed Model: Growing Area 025

Condemned Area	Livestock	Wildlife	Human	Pet
025-071A Totuskey & Richardson Creeks	45%	28%	16%	11%

FIGURE B.1 Diagram to Illustrate Procedure Used to Estimate Fecal Coliform Production from Estimated Livestock Population



Appendix C: Water Quality Data Summary

Table C.1 Observed Geometric Mean and 90th Percentile by Condemned Area and Station for Totuskey and Richardson Creeks

Condemned Area	DSS Station Number	Mean of Geometric Means	SD Geometric Means	Mean of the 90th Means	SD 90th Means	Last 30 Sample Geo mean	Last 30 Sample 90th
Totuskey Creek	25-1	15.24	5.25	99.70	58.59	10.63	88.60
	25-2	21.02	7.27	153.83	127.79	14.26	153.70
	25-3	27.78	11.03	227.90	150.57	23.94	324.26
	25-20_5	4.90	0.15	23.29	0.02	4.79	23.31
	25-24	11.01	4.62	68.08	39.86	10.90	67.82
Richardson Creek	25-17	31.12	14.90	243.73	171.87	20.68	172.12
	25-19_5	5.89	0.43	35.95	2.15	5.58	34.44
	25-25	10.61	5.90	63.27	49.05	9.98	91.99

Table C.2 Amount of Biosolids applied to the watershed

Farm Tracts (containing multiple fields)	Month and year of Application	Amount of Biosolids Applied (wet tons)	Watersheds
RI-00017, 00031	March 2001	862.75	Marshy Swamp, Unnamed tributary to Totuskey Cr
RI-00017, 00031	January 2003	1691.46	Marshy Swamp, Unnamed tributary to Totuskey Cr
RI-00017, 00031	December 2004	440.00	Marshy Swamp, Unnamed tributary to Totuskey Cr
RI-00003, 00017	February 2005	159.92	Drinking Sw, Mill Br, Marshy Sw, Unnamed tributary to Totuskey Cr
RI-00003, 00017	February 2006	205.96	Drinking Sw, Mill Br, Marshy Sw, Unnamed tributary to Totuskey Cr
RI-00037	March 2007	236.04	Little Totuskey Cr
RI-00003, 00017, 00031	April 2008	1272.87	Drinking Sw, Mill Br, Marshy Sw, Unnamed tributary to Totuskey Cr
RI-00017, 00037	July 2008	166.83	Marshy Swamp, Unnamed tributary to Totuskey Cr, Little Totuskey Cr
RI-00037	September 2008	363.33	Little Totuskey Cr
	Total :	5399.16	

Table C3. Bacteria Monitoring Results of DEQ Sampling at Beasley Septage Disposal Facility

Sample Date	Sample ID	Sample Location Description	Fecal Colifrom MPN/100mL	Recreation Use Standard (2003) MPN/100ml
4/7/2003	UTTOTUSBCR	UT to Totuskey Creek above Beasley Lagoons	2400	400
	SEPTAGE	Beasley Septage pool at dump site	45	
	UTTOTDSBCR	UT to Totuskey Creek below Beasley Lagoons	5400	
	BEAS CREEK	UT to UT Totuskey Creek DS Beasley fields	9200	
	BEASDUMP	Beasley Septage runoff below dumpsite	16000*	

Appendix D

1) Code of Virginia §62.1-194.1 Obstructing or contaminating state waters.
2) Code of Federal Regulations. Title 33, Volume 2, Parts 120 to 1999 Revised as of July 1, 2000

D1: Code of Virginia §62.1-194.1

§62.1-194.1. Obstructing or contaminating state waters.

Except as otherwise permitted by law, it shall be unlawful for any person to dump, place or put, or cause to be dumped, placed or put into, upon the banks of or into the channels of any state waters any object or substance, noxious or otherwise, which may reasonably be expected to endanger, obstruct, impede, contaminate or substantially impair the lawful use or enjoyment of such waters and their environs by others. Any person who violates any provision of this law shall be guilty of a misdemeanor and upon conviction be punished by a fine of not less than $100 nor more than $500 or by confinement in jail not more than twelve months or both such fine and imprisonment. Each day that any of said materials or substances so dumped, placed or put, or caused to be dumped, placed or put into, upon the banks of or into the channels of, said streams shall constitute a separate offense and be punished as such. In addition to the foregoing penalties for violation of this law, the judge of the circuit court of the county or corporation court of the city wherein any such violation occurs, whether there be a criminal conviction therefore or not shall, upon a bill in equity, filed by the attorney for the Commonwealth of such county or by any person whose property is damaged or whose property is threatened with damage from any such violation, award an injunction enjoining any violation of this law by any person found by the court in such suit to have violated this law or causing the same to be violated, when made a party defendant to such suit. (1968, c. 659.)

D2: Code of Federal Regulations. Title 33, Volume 2, Parts 120 to 1999 Revised as of July 1, 2000 From the U.S. Government Printing Office via GPO Access [CITE: 33CFR159]

NAVIGABLE WATERS

CHAPTER I--COAST GUARD, DEPARTMENT OF TRANSPORTATION (CONTINUED)

PART 159--MARINE SANITATION DEVICES

Subpart A--General

Sec.
159.1 Purpose.
159.3 Definitions.
159.4 Incorporation by reference.
159.5 Requirements for vessel manufacturers.
159.7 Requirements for vessel operators.

Subpart B--Certification Procedures

159.11 Purpose.

Subpart C--Design, Construction, and Testing

Subpart D--Recognition of Facilities

Authority: Sec. 312(b)(1), 86 Stat. 871 (33 U.S.C. 1322(b)(1)); 49 CFR 1.45(b) and 1.46(l) and (m).

Source: CGD 73-83, 40 FR 4624, Jan. 30, 1975, unless otherwise noted.

Subpart A--General

Sec. 159.1 Purpose.

This part prescribes regulations governing the design and construction of marine sanitation devices and procedures for certifying that marine sanitation devices meet the regulations and the standards of the Environmental Protection Agency promulgated under section 312 of the Federal Water Pollution Control Act (33 U.S.C. 1322), to eliminate the discharge of untreated sewage from vessels into the waters of the United States, including the territorial seas. Subpart A of this part contains regulations governing the manufacture and operation of vessels equipped with marine sanitation devices.

Sec. 159.3 Definitions.

In this part:
Coast Guard means the Commandant or his authorized representative.
Discharge includes, but is not limited to, any spilling, leaking, pouring, pumping, emitting, emptying, or dumping.
Existing vessel includes any vessel, the construction of which was initiated before January 30, 1975.
Fecal coliform bacteria are those organisms associated with the intestine of warm-blooded animals that are commonly used to indicate the presence of fecal material and the potential presence of organisms capable of causing human disease.
Inspected vessel means any vessel that is required to be inspected under 46 CFR Ch. I.
Length means a straight line measurement of the overall length from the foremost part of the vessel to the aftermost part of the vessel, measured parallel to the centerline. Bow sprits, bumpkins, rudders, outboard motor brackets, and similar fittings or attachments are not to be included in the measurement.
Manufacturer means any person engaged in manufacturing, assembling, or importing of marine sanitation devices or of vessels subject to the standards and regulations promulgated under section 312 of the Federal Water Pollution Control Act.
Marine sanitation device and device includes any equipment for installation on board a vessel which is designed to receive, retain, treat, or discharge sewage, and any process to treat such sewage.
New vessel includes any vessel, the construction of which is initiated on or after January 30, 1975.
Person means an individual, partnership, firm, corporation, or association, but does not include an individual on board a public vessel.
Public vessel means a vessel owned or bare-boat chartered and operated by the United States, by a State or political subdivision thereof, or by a foreign nation, except when such vessel is engaged in commerce.
Recognized facility means any laboratory or facility listed by the Coast Guard as a recognized facility under this part.
Sewage means human body wastes and the wastes from toilets and other receptacles intended to receive or retain body waste.
Territorial seas means the belt of the seas measured from the line of ordinary low water along that portion of the coast which is in direct contact with the open sea and the line marking the seaward limit of inland waters, and extending seaward a distance of 3 miles.
Type I marine sanitation device means a device that, under the test conditions described in Secs. 159.123 and 159.125, produces an effluent having a fecal coliform bacteria count not greater than 1,000 per 100 milliliters and no visible floating solids.
Type II marine sanitation device means a device that, under the test conditions described in Secs. 159.126 and 159.126a, produces an effluent having a fecal coliform bacteria count not greater than 200 per 100 milliliters and suspended solids not greater than 150 milligrams per liter.
Type III marine sanitation device means a device that is designed to prevent the overboard discharge of treated or untreated sewage or any waste derived from sewage.
Uninspected vessel means any vessel that is not required to be inspected under 46 CFR Chapter I.
United States includes the States, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, American Samoa, the Canal Zone, and the Trust Territory of the Pacific Islands.
Vessel includes every description of watercraft or other artificial contrivance used, or capable of being used, as a means of transportation on the waters of the United States.

[CGD 96-026, 61 FR 33668, June 28, 1996, as amended by CGD 95-028, 62 FR 51194, Sept. 30, 1997]

Sec. 159.4 Incorporation by reference.

(a) Certain material is incorporated by reference into this part with the approval of the Director of the Federal Register under 5 U.S.C. 552(a) and 1 CFR part 51. To enforce any edition other than that specified in paragraph (b) of this section, the Coast Guard must publish notice of change in the Federal Register; and the material must be available to the public. All approved material is available for inspection at the Office of the Federal Register, 800 North Capitol Street, NW., suite 700, Washington, DC, and at the U.S. Coast Guard Office of Design and Engineering Standards (G-MSE), 2100 Second Street SW., Washington, DC 20593-0001, and is available from the sources indicated in paragraph (b) of this section.

(b) The material approved for incorporation by reference in this part, and the sections affected, are as follows:

American Society for Testing and Materials (ASTM)
100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM E 11-95, Standard Specification for Wire Cloth and Sieves for Testing Purposes--159.125

[USCG-1999-5151, 64 FR 67176, Dec. 1, 1999]

Sec. 159.5 Requirements for vessel manufacturers.

No manufacturer may manufacture for sale, sell, offer for sale, or distribute for sale or resale any vessel equipped with installed toilet facilities unless it is equipped with:

(a) An operable Type II or III device that has a label on it under Sec. 159.16 or that is certified under Sec. 159.12 or Sec. 159.12a; or

(b) An operable Type I device that has a label on it under Sec. 159.16 or that is certified under Sec. 159.12, if the vessel is 19.7 meters (65 feet) or less in length.

[CGD 95-028, 62 FR 51194, Sept. 30, 1997]

Sec. 159.7 Requirements for vessel operators.

(a) No person may operate any vessel equipped with installed toilet facilities unless it is equipped with:

(1) An operable Type II or III device that has a label on it under Sec. 159.16 or that is certified under Sec. 159.12 or Sec. 159.12a; or

(2) An operable Type I device that has a label on it under Sec. 159.16 or that is certified under Sec. 159.12, if the vessel is 19.7 meters (65 feet) or less in length.

(b) When operating a vessel on a body of water where the discharge of treated or untreated sewage is prohibited by the Environmental Protection Agency under 40 CFR 140.3 or 140.4, the operator must secure each Type I or Type II device in a manner which prevents discharge of treated or untreated sewage. Acceptable methods of securing the device include--

(1) Closing the seacock and removing the handle;

(2) Padlocking the seacock in the closed position;

(3) Using a non-releasable wire-tie to hold the seacock in the closed position; or

(4) Locking the door to the space enclosing the toilets with a padlock or door handle key lock.

(c) When operating a vessel on a body of water where the discharge of untreated sewage is prohibited by the Environmental Protection Agency under 40 CFR 140.3, the operator must secure each Type III device in a manner which prevents discharge of sewage. Acceptable methods of securing the device include--

(1) Closing each valve leading to an overboard discharge and removing the handle;

(2) Padlocking each valve leading to an overboard discharge in the closed position; or

(3) Using a non-releasable wire-tie to hold each valve leading to an overboard discharge in the closed position.

[CGH 95-028, 62 FR 51194, Sept. 30, 1997]

Subpart B--Certification Procedures

Sec. 159.11 Purpose.

This subpart prescribes procedures for certification of marine sanitation devices and authorization for labels on certified devices.

Sec. 159.12 Regulations for certification of existing devices.

(a) The purpose of this section is to provide regulations for certification of existing devices until manufacturers can design and manufacture devices that comply with this part and recognized facilities are prepared to perform the testing required by this part.

(b) Any Type III device that was installed on an existing vessel before January 30, 1975, is considered certified.

(c) Any person may apply to the Commandant (G-MSE), U.S. Coast Guard, Washington, D.C. 20593-0001 for certification of a marine sanitation device manufactured before January 30, 1976. The Coast Guard will issue a letter certifying the device if the applicant shows that the device meets Sec. 159.53 by:

(1) Evidence that the device meets State standards at least equal to the standards in Sec. 159.53, or

(2) Test conducted under this part by a recognized laboratory, or

(3) Evidence that the device is substantially equivalent to a device certified under this section, or

(4) A Coast Guard field test if considered necessary by the Coast Guard.

(d) The Coast Guard will maintain and make available a list that identifies each device certified under this section.

(e) Devices certified under this section in compliance with Sec. 159.53 need not meet the other regulations in this part and may not be labeled under Sec. 159.16.

[CGD 73-83, 40 FR 4624, Jan. 30, 1975, as amended by CGD 75-213, 41 FR 15325, Apr. 12, 1976; CGD 82-063a, 48 FR 4776, Feb. 3, 1983; CGD 88-052, 53 FR 25122, July 1, 1988; CGD 96-026, 61 FR 33668, June 28, 1996]

Sec. 159.12a Certification of certain Type III devices.

(a) The purpose of this section is to provide regulations for certification of certain Type III devices.

(b) Any Type III device is considered certified under this section if:

(1) It is used solely for the storage of sewage and flushwater at ambient air pressure and temperature; and

(2) It is in compliance with Sec. 159.53(c).

(c) Any device certified under this section need not comply with the other regulations in this part except as required in paragraphs (b)(2)and (d) of this section and may not be labeled under Sec. 159.16.

d) Each device certified under this section which is installed aboard an inspected vessel must comply with Sec. 159.97.

[CGD 76-145, 42 FR 11, Jan. 3, 1977]

Sec. 159.14 Application for certification.

(a) Any manufacturer may apply to any recognized facility for certification of a marine sanitation device. The application for certification must indicate whether the device will be used aboard all vessels or only aboard uninspected vessels and to which standard in Sec. 159.53 the manufacturer requests the device to be tested.

(b) An application may be in any format but must be in writing and must be signed by an authorized representative of the manufacturer and include or be accompanied by:

(1) A complete description of the manufacturer's production quality control and inspection methods, record keeping systems pertaining to the manufacture of marine sanitation devices, and testing procedures;

(2) The design for the device, including drawings, specifications and other information that describes the materials, construction and operation of the device;

(3) The installation, operation, and maintenance instructions for the device; and

(4) The name and address of the applicant and the manufacturing facility.

(c) The manufacturer must furnish the recognized facility one device of each model for which certification is requested and samples of each material from which the device is constructed, that must be tested destructively under Sec. 159.117. The device furnished is for the testing required by this part except that, for devices that are not suited for unit testing, the manufacturer may submit the design so that the recognized facility may determine the components of the device and materials to be submitted for testing and the tests to be performed at a place other than the facility. The Coast Guard must review and accept all such determinations before testing is begun.

(d) At the time of submittal of an application to a recognized facility the manufacturer must notify the Coast Guard of the type and model of the device, the name of the recognized facility to which application is being made, and the name and address of the manufacturer, and submit a signed statement of the times when the manufacturer will permit designated officers and employees of the Coast Guard to have access to the manufacturer's facilities and all records required by this part.

[CGD 73-83, 40 FR 4624, Jan. 30, 1975, as amended by CGD 75-213, 41 FR 15325, Apr. 12, 1976]

Sec. 159.15 Certification.

(a) The recognized facility must evaluate the information that is submitted by the manufacturer in accordance with Sec. 159.14(b) (1), (2), and (3), evaluate the device for compliance with Secs. 159.53 through 159.95, test the device in accordance with Sec. 159.101 and submit to the Commandant (G-MSE), U.S. Coast Guard, Washington, D.C. 20593-0001 the following:

(1) The information that is required under Sec. 159.14(b);

(2) A report on compliance evaluation;

(3) A description of each test;

(4) Test results; and

(5) A statement, that is signed by the person in charge of testing, that the test results are accurate and complete.

(b) The Coast Guard certifies a test device, on the design of the device, if it determines, after consideration of the information that is required under paragraph (a) of this section, that the device meets the requirements in Subpart C of this part.

(c) The Coast Guard notifies the manufacturer and recognized facility of its determination under paragraph (b) of this section. If the device is certified, the Coast Guard includes a certification number for the device. If certification is denied, the Coast Guard notifies the manufacturer and recognized facility of the requirements of this part that are not met. The manufacturer may appeal a denial to the Commandant (G-MSE), U.S. Coast Guard, Washington, D.C. 20593-0001.

(d) If upon re-examination of the test device, the Coast Guard determines that the device does not in fact comply with the requirements of Subpart C of this part, it may terminate the certification.

[CGD 73-83, 40 FR 4624, Jan. 30, 1975, as amended by CGD 75-213, 41 FR 15326, Apr. 12, 1976; CGD 82-063a, 48 FR 4776, Feb. 3, 1983; CGD 88-052, 53 FR 25122, July 1, 1988; CGD 96-026, 61 FR 33668, June 28, 1996]

Sec. 159.16 Authorization to label devices.

(a) When a test device is certified under Sec. 159.15(b), the Coast Guard will issue a letter that authorizes the manufacturer to label each device that he manufactures with the manufacturer's certification that the device is in all material respects substantially the same as a test device certified by the U.S. Coast Guard pursuant to section 312 of the Federal Water Pollution Control Act Amendments of 1972.

(b) Certification placed on a device by its manufacturer under this section is the certification required by section 312(h)(4) of the Federal Water Pollution Control Act Amendments of 1972, which makes it unlawful for a vessel that is subject to the standards and regulations promulgated under the Act to operate on the navigable waters of the United States, if such vessel is not equipped with an operable marine sanitation device certified pursuant to section 312 of the Act.

(c) Letters of authorization issued under this section are valid for 5 years, unless sooner suspended, withdrawn, or terminated and may be reissued upon written request of the manufacturer to whom the letter was issued.

(d) The Coast Guard, in accordance with the procedure in 46 CFR 2.75, may suspend, withdraw, or terminate any letter of authorization issued under this section if the Coast Guard finds that the manufacturer is engaged in the manufacture of devices labeled under this part that are not in all material respects substantially the same as a test device certified pursuant to this part.

Sec. 159.17 Changes to certified devices.

(a) The manufacturer of a device that is certified under this part shall notify the Commandant (G-MSE), U.S. Coast Guard, Washington, D.C. 20593-0001 in writing of any change in the design of the device.

(b) A manufacturer shall include with a notice under paragraph (a) of this section a description of the change, its advantages, and the recommendation of the recognized facility as to whether the device remains in all material respects substantially the same as the original test device.

(c) After notice under paragraph (a) of this section, the Coast Guard notifies the manufacturer and the recognized facility in writing of any tests that must be made for certification of the device or for any change in the letter of authorization. The manufacturer may appeal this determination to the Commandant (G-MSE), U.S. Coast Guard, Washington, D.C. 20593-0001.

[CGD 73-83, 40 FR 4624, Jan. 30, 1975, as amended by CGD 82-063a, 48 FR 4776, Feb. 3, 1983; CGD 88-052, 53 FR 25122, July 1, 1988; CGD 96-026, 61 FR 33668, June 28, 1996]

Sec. 159.19 Testing equivalency.

(a) If a test required by this part may not be practicable or necessary, a manufacturer may apply to the Commandant (G-MSE), U.S. Coast Guard, Washington, DC 20593-0001 for deletion or approval of an alternative test as equivalent to the test requirements in this part. The application must include the manufacturer's justification for deletion or the alternative test and any alternative test data.

(b) The Coast Guard notifies the manufacturer of its determination under paragraph (a) of this section and that determination is final.

[CGD 73-83, 40 FR 4624, Jan. 30, 1975, as amended by CGD 82-063a, 48 FR 4776, Feb. 3, 1983; CGD 88-052, 53 FR 25122, July 1, 1988; CGD 96-026, 61 FR 33668, June 28, 1996]

Subpart C--Design, Construction, and Testing

Sec. 159.51 Purpose and scope.

(a) This subpart prescribes regulations governing the design and construction of marine sanitation devices.
(b) Unless otherwise authorized by the Coast Guard each device for which certification under this part is requested must meet the requirements of this subpart.

Sec. 159.53 General requirements.

A device must:
(a) Under the test conditions described in Secs. 159.123 and 159.125, produce an effluent having a fecal coliform bacteria count not greater than 1,000 per 100 milliliters and no visible floating solids (Type I),
(b) Under the test conditions described in Secs. 159.126 and 159.126a, produce an effluent having a fecal coliform bacteria count not greater than 200 per 100 milliliters and suspended solids not greater than 150 milligrams per liter (Type II), or
(c) Be designed to prevent the overboard discharge of treated or untreated sewage or any waste derived from sewage (Type III).

[CGD 73-83, 40 FR 4624, Jan. 30, 1975, as amended by CGD 75-213, 41 FR 15325, Apr. 12, 1976]

Sec. 159.55 Identification.

(a) Each production device must be legibly marked in accordance with paragraph (b) of this section with the following information:
(1) The name of the manufacturer.
(2) The name and model number of the device.
(3) The month and year of completion of manufacture.
(4) Serial number.
(5) Whether the device is certified for use on an inspected or an uninspected vessel.
(6) Whether the device is Type I, II, or III.
(b) The information required by paragraph (a) of this section must appear on a nameplate attached to the device or in lettering on the device. The nameplate or lettering stamped on the device must be capable of withstanding without loss of legibility the combined effects of normal wear and tear and exposure to water, salt spray, direct sunlight, heat, cold, and any substance listed in Sec. 159.117(b) and (c). The nameplate and lettering must be designed to resist efforts to remove them from the device or efforts to alter the information stamped on the nameplate or the device without leaving some obvious evidence of the attempted removal or alteration.

[CGD 73-83, 40 FR 4624, Jan. 30, 1975, as amended by CGD 75-213, 41 FR 15325, Apr. 12, 1976]

Sec. 159.57 Installation, operation, and maintenance instructions.

(a) The instructions supplied by the manufacturer must contain directions for each of the following:
(1) Installation of the device in a manner that will permit ready access to all parts of the device requiring routine service and that will provide any flue clearance necessary for fire safety.
(2) Safe operation and servicing of the device so that any discharge meets the applicable requirements of Sec. 159.53.
(3) Cleaning, winter layup, and ash or sludge removal.
(4) Installation of a vent or flue pipe.
(5) The type and quantity of chemicals that are required to operate the device, including instructions on the proper handling, storage and use of these chemicals.
(6) Recommended methods of making required plumbing and electrical connections including fuel connections and supply circuit overcurrent protection.
(b) The instructions supplied by the manufacturer must include the following information:
(1) The name of the manufacturer.
(2) The name and model number of the device.
(3) Whether the device is certified for use on an inspected, or uninspected vessel.
(4) A complete parts list.
(5) A schematic diagram showing the relative location of each part.
(6) A wiring diagram.
(7) A description of the service that may be performed by the user without coming into contact with sewage or chemicals.

(8) Average and peak capacity of the device for the flow rate, volume, or number of persons that the device is capable of serving and the period of time the device is rated to operate at peak capacity.

(9) The power requirements, including voltage and current.

(10) The type and quantity of fuel required.

(11) The duration of the operating cycle for unitized incinerating devices.

(12) The maximum angles of pitch and roll at which the device operates in accordance with the applicable requirements of Sec. 159.53.

(13) Whether the device is designed to operate in salt, fresh, or brackish water.

(14) The maximum hydrostatic pressure at which a pressurized sewage retention tank meets the requirements of Sec. 159.111.

(15) The maximum operating level of liquid retention components.

(16) Whether the device is Type I, II, or III.

(17) A statement as follows:

Note: The EPA standards state that in freshwater lakes, freshwater reservoirs or other freshwater impoundments whose inlets or outlets are such as to prevent the ingress or egress by vessel traffic subject to this regulation, or in rivers not capable of navigation by interstate vessel traffic subject to this regulation, marine sanitation devices certified by the U.S. Coast Guard installed on all vessels shall be designed and operated to prevent the overboard discharge of sewage, treated or untreated, or of any waste derived from sewage. The EPA standards further state that this shall not be construed to prohibit the carriage of Coast Guard-certified flow-through treatment devices which have been secured so as to prevent such discharges. They also state that waters where a Coast Guard-certified marine sanitation device permitting discharge is allowed include coastal waters and estuaries, the Great Lakes and interconnected waterways, freshwater lakes and impoundments accessible through locks, and other flowing waters that are navigable interstate by vessels subject to this regulation (40 CFR 140.3).

[CGD 73-83, 40 FR 4624, Jan. 30, 1975, as amended by CGD 75-213, 41 FR 15325, Apr. 12, 1976]

Sec. 159.59 Placard.

Each device must have a placard suitable for posting on which is printed the operating instructions, safety precautions, and warnings pertinent to the device. The size of the letters printed on the placard must be one-eighth of an inch or larger.

Sec. 159.61 Vents.

Vents must be designed and constructed to minimize clogging by either the contents of the tank or climatic conditions such as snow or ice.

Sec. 159.63 Access to parts.

Each part of the device that is required by the manufacturer's instructions to be serviced routinely must be readily accessible in the installed position of the device recommended by the manufacturer.

Sec. 159.65 Chemical level indicator.

The device must be equipped with one of the following:

(a) A means of indicating the amount in the device of any chemical that is necessary for its effective operation.

(b) A means of indicating when chemicals must be added for the proper continued operation of the device.

Sec. 159.67 Electrical component ratings.

Electrical components must have current and voltage ratings equal to or greater than the maximum load they may carry.

Sec. 159.69 Motor ratings.

Motors must be rated to operate at 50 deg.C ambient temperature.

Sec. 159.71 Electrical controls and conductors.

Electrical controls and conductors must be installed in accordance with good marine practice. Wire must be copper and must be stranded. Electrical controls and conductors must be protected from exposure to chemicals and sewage.

Sec. 159.73 Conductors.

Current carrying conductors must be electrically insulated from non-current carrying metal parts.

Sec. 159.75 Overcurrent protection.

Overcurrent protection must be provided within the unit to protect subcomponents of the device if the manufacturer's recommended supply circuit overcurrent protection is not adequate for these subcomponents.

Sec. 159.79 Terminals.

Terminals must be solderless lugs with ring type or captive spade ends, must have provisions for being locked against movement from vibration, and must be marked for identification on the wiring diagram required in Sec. 159.57. Terminal blocks must be nonabsorbent and securely mounted. Terminal blocks must be provided with barrier insulation that prevents contact between adjacent terminals or metal surfaces.

Sec. 159.81 Baffles.

Baffles in sewage retention tanks, if any, must have openings to allow liquid and vapor to flow freely across the top and bottom of the tank.

Sec. 159.83 Level indicator.

Each sewage retention device must have a means of indicating when the device is more than \3/4\ full by volume.

Sec. 159.85 Sewage removal.

The device must be designed for efficient removal of nearly all of the liquid and solids in the sewage retention tank.

Sec. 159.87 Removal fittings.

If sewage removal fittings or adapters are provided with the device, they must be of either 1\1/2\" or 4" nominal pipe size.

Sec. 159.89 Power interruption: Type I and II devices.

A discharge device must be designed so that a momentary loss of power during operation of the device does not allow a discharge that does not meet the requirements in Sec. 159.53.

[CGD 73-83, 40 FR 4624, Jan. 30, 1975, as amended by CGD 75-213, 41 FR 15326, Apr. 12, 1976]

Sec. 159.93 Independent supporting.

The device must have provisions for supporting that are independent from connecting pipes.

Sec. 159.95 Safety.

(a) Each device must--

(1) Be free of design defects such as rough or sharp edges that may cause bodily injuries or that would allow toxic substances to escape to the interior of the vessel;

(2) Be vented or provided with a means to prevent an explosion or over pressurization as a result of an accumulation of gases; and

(3) Meet all other safety requirements of the regulations applicable to the type of vessel for which it is certified.

(b) A chemical that is specified or provided by the manufacturer for use in the operation of a device and is defined as a hazardous material in 46 CFR Part 146 must be certified by the procedures in 46 CFR Part 147.

(c) Current carrying components must be protected from accidental contact by personnel operating or routinely servicing the device. All current carrying components must as a minimum be of drip-proof construction or be enclosed within a drip-proof compartment.

Sec. 159.97 Safety: inspected vessels.

The Commandant approves the design and construction of devices to be certified for installation and operation on board

inspected vessels on the basis of tests and reports of inspection under the applicable marine engineering requirements in Subchapter F of Title 46, Code of Federal Regulations, and under the applicable electrical engineering requirements in Subchapter J of Title 46 Code of Federal Regulations.

[CGD 73-83, 40 FR 4624, Jan. 30, 1975, as amended by CGD 75-213, 41 FR 15326, Apr. 12, 1976]

Sec. 159.101 Testing: general.

Unless otherwise authorized by the Coast Guard, a recognized facility must perform each test described in Secs. 159.103 through 159.131. The same device must be used for each test and tested in the order in which the tests are described. There must be no cracking, softening, deterioration, displacement, breakage, leakage or damage of components or materials that affects the operation or safety of the device after each test described in Secs. 159.103 through 159.117 and Sec. 159.121, and the device must remain operable after the test described in Sec. 159.119. The device must be set up in a manner simulating installation on a vessel in accordance with the manufacturer's instructions with respect to mounting, water supply, and discharge fittings.

[CGD 73-83, 40 FR 4624, Jan. 30, 1975, as amended by CGD 75-213, 41 FR 15326, Apr. 12, 1976]

Sec. 159.103 Vibration test.

The device, with liquid retention components, if any, filled with water to one-half of their volume, must be subjected to a sinusoidal vibration for a period of 12 hours, 4 hours in each of the x, y, and z planes, at the resonant frequency of the device (or at 55 cycles per second if there is no resonant frequency between 10 to 60 hertz) and with a peak amplitude of 0.019 to 0.021 inches.

Sec. 159.105 Shock test.

The device, with liquid retention components, if any, filled with water to half of their volume, must be subjected to 1,000 vertical shocks that are ten times the force of gravity (10g) and have a duration of 20-25 milliseconds measured at the base of the half-sine shock envelope.

Sec. 159.107 Rolling test.

(a) The device, with liquid retention components, if any, filled with water to half of their volume, must be subjected to 100 cycles with the axis of rotation 4 feet from the centerline of the device, no more than 6 inches below the plane of the bottom of the device, and parallel to any tank baffles. The device must then be rotated 90 degrees on its vertical axis and subjected to another 100 cycles. This testing must be repeated with the liquid retention components filled to the maximum operating level as specified by the manufacturer in Sec. 159.57.

(b) Eighty percent of the rolling action must be approximately 15 degrees on either side of the vertical and at a cyclic rate of 3 to 4 seconds. Twenty percent motions must be approximately 30 degrees, or the maximum angle specified by the manufacturer under Sec. 159.57, whichever is greater, on either side of the vertical at a cyclic rate of 6 to 8 seconds.

Sec. 159.109 Pressure test.

Any sewage retention tank that is designed to operate under pressure must be pressurized hydrostatically at a pressure head of 7 feet or to 150 percent of the maximum pressure specified by the manufacturer for operation of the tank, whichever is greater. The tank must hold the water at this pressure for 1 hour with no evidence of leaking.

Sec. 159.111 Pressure and vacuum pulse test.

Liquid retention components of the device with manufacturer specified venting installed must be subjected to 50 fillings of water at a pressure head of 7 feet or the maximum pressure specified by the manufacturer for operation of the device, whichever is greater, and then emptied with a 45 gallon per minute or larger positive displacement pump that remains in operation 30 seconds after emptying the tank at the end of each cycle.

Sec. 159.115 Temperature range test.

(a) The device must be held at a temperature of 60 deg.C or higher for a period of 16 hours.
(b) The device must be held at a temperature of -40 deg.C or less for a period of 16 hours following winterization in accordance with manufacturers' instructions.

Sec. 159.117 Chemical resistance test.

(a) In each case where the recognized facility doubts the ability of a material to withstand exposure to the substances listed in paragraphs (b) and (c) of this section a sample of the material must be tested.
(b) A sample referred to in paragraph (a) of this section must be partially submerged in each of the following substances for 100 hours at an ambient temperature of 22 deg.C.
(1) Sewage.
(2) Any disinfectant that is required in the operation of the device.
(3) Any chemical compound in solid, liquid or gaseous form, used, emitted or produced in the operation of the device.
(4) Fresh or salt (3.5 percent Sodium Chloride) flush water.
(5) Toilet bowl cleaners.
(6) Engine Oil (SAE/30).
(7) Ethylene Glycol.
(8) Detergents (household and bilge cleaning type).
(c) A sample of the material must be doused 20 times, with a 1 hour drying period between dousings, in each of the following substances:
(1) Gasoline.
(2) Diesel fuel.
(3) Mineral spirits.
(4) Turpentine.
(5) Methyl alcohol.

Sec. 159.119 Operability test; temperature range.

The device must operate in an ambient temperature of 5 deg.C with inlet operating fluid temperature varying from 2 deg.C to 32 deg.C and in an ambient temperature of 50 deg.C with inlet operating fluid temperature varying from 2 deg.C to 32 deg.C.

Sec. 159.121 Sewage processing test.

(a) The device must process human sewage in the manner for which it is designed when tested in accordance with this section. There must be no sewage or sewage-treating chemicals remaining on surfaces or in crevices that could come in contact with a person using the device or servicing the device in accordance with the instructions supplied under Sec. 159.57(b)(7).
(b) During the test the device must be operated and maintained in accordance with the manufacturer's instructions. Any initial start-up time specified by the manufacturer must be allowed before test periods begin. For 1 hour of each 8-hour test period, the device must be tilted to the maximum angles specified by the manufacturer under Secs. 159.55 and 159.57.
(c) Except for devices described in paragraph (d) of this section, the devices must process and discharge or store human sewage over at least an 8-consecutive hour period on at least 10 days within a 20-day period. The device must receive human sewage consisting of fecal matter, urine, and toilet paper in a ratio of four urinations to one defecation with at least one defecation per person per day. Devices must be tested at their average rate of capacity as specified in Sec. 159.57. In addition, during three periods of each day the system must process sewage at the peak capacity for the period of time it is rated at peak capacity.

(d) A device that processes and discharges continuously between individual use periods or a large device, as determined by the Coast Guard, must process and discharge sewage over at least 10-consecutive days at the average daily capacity specified by the manufacturer. During three periods of each day the system must process sewage at the peak capacity for the period of time it is rated at peak capacity. The sewage for this test must be fresh, domestic sewage to which primary sludge has been added, as necessary, to create a test sewage with a minimumof 500 milligrams of suspended solids per liter.

Sec. 159.123 Coliform test: Type I devices.

(a) The arithmetic mean of the fecal coliform bacteria in 38 of 40 samples of effluent discharged from a Type I device during the test described in Sec. 159.121 must be less than 1000 per 100 milliliters when tested in accordance with 40 CFR Part 136.

(b) The 40 samples must be taken from the device as follows: During each of the 10-test days, one sample must be taken at the beginning, middle, and end of an 8-consecutive hour period with one additional sample taken immediately following the peak capacity processing period.

[CGD 73-83, 40 FR 4624, Jan. 30, 1975, as amended by CGD 75-213, 41 FR 15326, Apr. 12, 1976]

Sec. 159.125 Visible floating solids: Type I devices.

During the sewage processing test (Sec. 159.121) 40 effluent samples of approximately 1 liter each shall be taken from a Type I device at the same time as samples taken in Sec. 159.123 and passed expeditiously through a U.S. Sieve No. 12 as specified in ASTM E 11 (incorporated by reference, see Sec. 159.4). The weight of the material retained on the screen after it has been dried to a constant weight in an oven at 103 deg.C. must be divided by the volume of the sample and expressed as milligrams per liter. This value must be 10 percent or less of the total suspended solids as determined in accordance with 40 CFR Part 136 or at least 38 of the 40 samples.

Note: 33 U.S.C. 1321(b)(3) prohibits discharge of harmful quantities of oil into or upon the navigable waters of the United States or adjoining shorelines or into or upon the waters of the contiguous zone. Under 40 CFR 110.3 and 110.4 such discharges of oil include discharges which:

(a) Violate applicable water quality standards, or

(b) Cause a film or sheen upon or discoloration of the surface of the water or adjoining shorelines or cause a sludge or emulsion to be deposited beneath the surface of the water or upon adjoining shorelines. If a sample contains a quantity of oil determined to be harmful, the Coast Guard will not certify the device.

[CGD 73-83, 40 FR 4624, Jan. 30, 1975, as amended by CGD 75-213, 41 FR 15326, Apr. 12, 1976; USCG-1999-5151, 64 FR 67176, Dec. 1, 1999]

Sec. 159.126 Coliform test: Type II devices.

(a) The arithmetic mean of the fecal coliform bacteria in 38 of 40 samples of effluent from a Type II device during the test described in Sec. 159.121 must be 200 per 100 milliliters or less when tested in accordance with 40 CFR Part 136.

(b) The 40 samples must be taken from the device as follows: During each of the 10 test days, one sample must be taken at the beginning, middle and end of an 8-consecutive hour period with one additional sample taken immediately following the peak capacity processing period.

[CGD 75-213, 41 FR 15326, Apr. 12, 1976]

Sec. 159.126a Suspended solids test: Type II devices.

During the sewage processing test (Sec. 159.121) 40 effluent samples must be taken at the same time as samples are taken for Sec. 159.126 and they must be analyzed for total suspended solids in accordance with 40 CFR Part 136. The arithmetic mean of the total suspended solids in 38 of 40 of these samples must be less than or equal to 150 milligrams per liter.

[CGD 75-213, 41 FR 15326, Apr. 12, 1976]

Sec. 159.127 Safety coliform count: Recirculating devices.

Thirty-eight of forty samples of flush fluid from a re-circulating device must have less than 240 fecal coliform bacteria per 100 milliliters. These samples must be collected in accordance with Sec. 159.123(b) and tested in accordance with 40 CFR Part 136.

[CGD 73-83, 40 FR 4624, Jan. 30, 1975, as amended by CGD 75-213, 41 FR 15326, Apr. 12, 1976]

Sec. 159.129 Safety: Ignition prevention test.

(a) Components of a device that are a potential ignition source in an explosive atmosphere must pass the test in paragraph (b) or (c) of this section or meet the requirements of paragraph (d) or have a specific warning in the instruction manual required by Sec. 159.57 that the device should not be installed in an explosive atmosphere.

(b) Components protected by vapor exclusion must be placed in a chamber filled with a rich mixture of gasoline or propane in air with the pressure being varied from 0 to 2 psig once an hour for 8 hours. Vapor readings must be taken in the void being protected and must indicate a leakage less than 20 percent of the lower explosive limit of the mixture in the chamber.

(c) Components providing ignition protection by means other than vapor exclusion must be fitted with an ignition source, such as a spark plug, and a means of injecting an explosive mixture of gasoline or propane and air into the void that protects the component. Connections must be made so as to minimize any additional volume added to the protected void by the apparatus delivering the explosive mixture. The component must be placed in a chamber filled with an explosive mixture and there must be no ignition of the explosive mixture surrounding the component when the following tests are conducted:

(1) Using any overload protection that is part of the device, the potential ignition source must be operated for one half hour at 110 percent of its rated voltage, one half hour at 50 percent of its rated voltage and one half hour at 100 percent of its rated voltage with the motor or armature locked, if the potential ignition source is a motor or part of a motor's electrical circuit.

(2) With the explosive mixture in the protected void, the test installed ignition source must be activated 50 times.

(3) The tests paragraphs (c) (1) and (2) of this section must be repeated with any plugs removed.

(d) Components that are certified as being intrinsically safe in accordance with the Instrument Society of America (RP 12.2) or explosion proof in accordance with the Underwriters Laboratories STD 698 in Class I, Group D hazardous locations (46 CFR 111.80-5(a)) need not be subjected to this testing.

Sec. 159.131 Safety: Incinerating device.

An incinerating device must not incinerate unless the combustion chamber is closed, must purge the combustion chamber of combustible fuel vapors before and after incineration must secure automatically if the burner does not ignite, must not allow an accumulation of fuel, and must neither produce a temperature on surfaces adjacent to the incineration chamber higher than 67 deg.C nor produce a temperature on surfaces in normal body contact higher than 41 deg.C when operating in an ambient temperature of 25 deg.C. Unitized incineration devices must completely burn to a dry, inert ash, a simultaneous defecation and urination and must not discharge fly ash, malodors, or toxic substances.

Subpart D--Recognition of Facilities

Sec. 159.201 Recognition of facilities.

A recognized facility is an independent laboratory accepted by the Coast Guard under 46 CFR 159.010 to perform the tests and inspections required under this part. A list of accepted laboratories is available from the Commandant (G-MSE-3).

[CGD 95-028, 62 FR 51194, Sept. 30, 1997, as amended by USCG-1999-5832, 64 FR 34715, June 29, 1999]

Appendix E: Public Comments

DEQ Response to DCR Comments on
Totuskey and Richardson Creeks Shellfish
Bacteria TMDL Report
11/6/2009

DCR comments appear in black while DEQ responses are in blue italics.

vii. – in 1st sentence, the word "achieve" has an extra space
Corrected

Page 1 – in next to last paragraph, the word "pathogenic" has an extra space
Corrected

Page 4 – there may now be more recent (2007), digitized land use available from the Northern Neck Planning District Commission, and if it is not too much trouble it may good to compare them from the land use in report. If significant difference noted, please add the 2007 land use data to the report.
Thank you for this information. For any other TMDLs that we develop in the Northern Neck, PRO-DEQ will be certain to check with the NNPDC for their current version of land use files. Updated land use which is available from the Northern Neck Planning District Commision can be used during Implementation Planning to update any additional changes that have occurred within watershed.

Page 7 – Under the Geology and Soils section, the word "Plain" in the 1st sentence contains an extra space
Corrected

Page 13, and other locations – the words "*Enterococci* and *Enteroccus*" should be italicized throughout document

Referring to various journals with suggestions regarding bacterial nomenclature, (see Journal of Antimicrobial Chemotherapy, Advice to contributors as an example) it was found that when generically referred to, both singular and plural forms of a bacterial genus name could be used without the first letter capitalized and without the use of italics. However, when referring specifically to the Enterococusi group, first letter should be capitalized and italics should be used. In this and future TMDLs, we will use this nomenclature.

Page 14 – in the 3rd paragraph from the bottom, the word "bacterial" has an extra space
Corrected

Page 15, under B. Non-Point Source, - suggest the wording "….may occur over the entire watershed of the receiving water."
Thank you for the suggestion. DEQ has replaced "length" with "watershed".

Page 15 – Due to the fact that the sewage lagoons are listed in the Shoreline Survey as a "Sewage Pollution Sources" and they may be covered by a VDH permit, they should be identified in Section B. Since there was considerable discussion at the final public meeting regarding the maintenance and upkeep of these lagoons and property surrounding the site adjacent to Richardson Creek, it would be useful to report on any conclusive findings of DEQ Pollution Response staff. As well, any explanation on how the facility is supposed to be operated would be useful to include in the document.
DEQ has included the septic hauler's VDH permit information and results of DEQ pollution response inspections.

The following will appear under Section 4.3 Fecal Coliform Bacteria Source Assessment, Part B. Nonpoint Source, page 15:

"A VDH permitted non-point source facility, Beasley Septage Disposal Facility (#179-01), lies within the drainage of an unnamed tributary to Totuskey Creek. This facility may also land apply effluent within its permit (at specified locations on the same property). DEQ pollution response staff has inspected the facility three times, the first beginning in 2003 with return visits in 2007 and 2009. During DEQ visits at the facility, the septage lagoons were observed with less than the required 2 feet of freeboard space and staff reported physical evidence along the lagoon berms to suggest that overflows of the septic lagoons have occurred at some point in time. Monitoring was conducted during by DEQ in 2003 to gauge bacteria concentrations downstream of the lagoons along the unnamed tributary. The results, which included violations of the recreational and shellfish use water quality standards, are in Table C3 Appendix C. During a follow-up inspection by VDH personnel in 2009, the septage lagoons were observed with a minimum of 2' freeboard and the inspector noticed no evidence of overflow although there was erosion along the berm of the lagoons. The facility should be involved during implementation planning."

The following will appear under Table C3. Bacteria Monitoring Results of DEQ Sampling at Beasley Septage Disposal Facility, Appendix C, page 62:

Sample Date	Sample ID	Sample Location Description	Fecal Coliform MPN/100mL	Recreation Use Standard (2003) MPN/100ml
4/7/2003	UTTOTUSBCR	UT to Totuskey Creek above Beasley Lagoons	2400	400
	SEPTAGE	Beasley Septage pool at dump site	45	
	UTTOTDSBCR	UT to Totuskey Creek below Beasley Lagoons	5400	
	BEAS CREEK	UT to UT Totuskey Creek DS Beasley fields	9200	
	BEASDUMP	Beasley Septage runoff below dumpsite	16000*	

Page 25, Table 5.1 – There was a discussion of this table at the final public meeting. The WLA was subtracted from the TMDL Allowable load during the meeting. Please check the values in this table to be sure a part of the calculation is not left out as it will effect the required reduction needed.

During the final meetings, a citizen asked about the loading of a WWTF to the Totuskey and Richardson Creeks. Based on the design flow of the facility this citizen mentioned, I calculated the overall percentage of contribution from the faciility's outfall as a portion of the allowable TMDL figure. The percentage that resulted (based on the facility's WLA) was very small (less than 1/10 thousandths of a percent). This calculation was done to show the citizen that small municipal or county treatment facilities tend to be very minor contributors (if at all) to bacteria impairments. Given the self-reporting required of facilities, DEQ tracks overflows and bacteria exceedences and regulates such facilities to maintain compliance under the Water Quality Standards (WQS) mentioned in the facility's permit. Instances of overflows and exceedences of the bacteria WQS's by facilities have been documented in the TMDL report. This was not a discussion regarding the accuracy of the TMDL calculation. The calculations within the report have been reviewed and are believed to be correct.

Page 30, 6.2 – Reference to the Northern Neck SWCD should be as a conservation partner of DCR, not a subsidiary.

Corrected